Outline of Course of Study

Faculty of Engineering Secondary School (FESS)
Department of Engineering

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Course title: Computer Technology

Grade: 10

Type: Open

Ministry Course Code: TEJ2O

Credit value: 1.0 credit

Ministry curriculum policy documents:

- Ministry of education, technological course currilcum and resources
- Growing Success: Assessment, Evaluation, and Reporting in Ontario's Schools

Prerequisites and corequisites: none

Course Description

Artificial Intelligence

AI might very well be the next “industrial revolution” and here at the university of Ottawa, Faculty of Engineering Secondary School, we embrace it! Using different electronic circuits and micro-controllers, students will apply the Engineering Design Process (EDP) to design, program, and test a variety of programs involving artificial intelligence. The course’s final assignment, worth 30% of the students’ final grade, is a creative project where students will design a real Artificial Intelligence device that responds to external stimuli!

Quantum computing

Students will first be introduced to classical computing fundamentals (circuits, bits, gates) then quickly move on to study qubit, quantum gates, and quantum computing. Students will learn programming using Python in a hands-on way through interactive quantum simulators, partially complete coding notebooks, and beginner-friendly assignments. Throughout the course, students will learn about and apply the Engineering Design Process as it pertains to quantum computing. Assignments are scaffolded according to students’ abilities.

Cyber security

Students will design, configure, and test different computer networks, identify cybersecurity risks, and different encryption methods used to secure data. Students will examine the different effects on society, including ethical and security issues related to the widespread usage of computers and associated technologies.

To further enrich students’ learning, the Cybersecurity unit is integrated with the university of Ottawa **Cyber-Range laboratory.** The university of Ottawa Cyber-Range laboratory is a one-of-a-kind unique training, learning, and research facility offering a full, immersive, and interactive training setting where students, including government organizations, experience real cyber response scenarios. Students will learn how to anticipate, respond to, manage, contain, and remediate cyber-attacks.

uOttawa-IBM Cyber Range Lab

https://www.uottawa.ca/faculty-engineering/spaces/cyber-range

Overall, this course introduces students to computer systems, networking, and interfacing, as well as electronics and robotics. Students will assemble, repair, and configure computers with various types of operating systems and application software. Students will build small electronic circuits and write computer programs to control simple peripheral devices or robots. Students will also develop an awareness of related environmental and societal issues and will learn about secondary and postsecondary pathways and career opportunities in computer technology.

Overall Curriculum Expectations

By the end of the course, students will:

A. COMPUTER TECHNOLOGY FUNDAMENTALS	
A1	identify and describe the functions of, as well as important advances related to, electronic and computer components;
A2	demonstrate a basic understanding of computer networks and their components;
A3	demonstrate a basic understanding of binary numbers and digital logic.
B. COMPUTER TECHNOLOGY SKILLS	
B1	install and configure the hardware and operating system of a workstation, and use file management techniques effectively;

B2	construct and test simple interfaces and other electronic circuits;
B3	assemble and configure a simple computer network;
B4	install and use a variety of software;
B5	apply fundamental programming concepts to develop a variety of simple programs, including a program to control an external device.
C. TECHNOLOGY, THE ENVIRONMENT, AND SOCIETY	
C1	identify harmful effects of the widespread use of computers and associated technologies on the environment, as well as agencies that reduce these effects;
C2	identify effects of the widespread use of computers and associated technologies on society.
D. PROFESSIONAL PRACTICE AND CAREER OPPORTUNITIES	
D1	follow appropriate health and safety procedures when assembling, using, and maintaining computer systems;
D2	demonstrate an understanding of ethical and security issues related to the use of computers;
D3	identify various careers related to computer technology and describe the education and/or training required for them.

Outline of Course Content

Unit 1: Computer Networks	**10hrs**
In this unit, students are introduced to different types of computer network topologies (point-to-point, star, ring, mesh, hybrid) and their components (server, workstation, NIC, network cables, router, hub, bridges). Students build different network topologies with appropriate IP protocols to meet the needs required by different real-life scenarios. (A1, A2, and B3)	
Unit 2: Electronic circuits, binary numbers and digital logic gates	**12hrs**
This is the unit where students learn about classical digital logic and Boolean functions. Students learn that logic gates are the building blocks of digital circuits which are in turn, at the heart of computer operations. While building different electronic circuits, students are	

introduced to binary numbers, digital logic gates, and their truth table (A2, B3)	
Unit 3: Computational Thinking	**8 hours**
Students apply the Engineering Design Process to apply fundamental programming concepts to develop a variety of simple programs (if/then/else, loop, variables, functions) in Python, including a program to control an external device such as an Arduino. (B5)	
Unit 4: Quantum Information and Computing	**10 hours**
Students identify and describe the functions of, as well as important advances related to electronic and computer components. Students install and configure their workstation in preparation for using a quantum computer. Students construct quantum circuits, demonstrating their understanding of quantum bits, two qubit gates, and electronic circuits. Students are introduced to quantum teleportation. (A1, A3, and B1)	
Unit 5: Quantum programming	**10 hours**
Using Python, students use classical and quantum registers alongside one qubit gates to code quantum circuits. Students demonstrate their ability to apply fundamental programming concepts and convert any quantum circuit into code that can be programmed on a quantum computer. (B1, B2, B4, B5)	
Unit 6: Mathematical Representation of Qubits	**5 hours**
Students are introduced to the advanced mathematics that is used to model quantum technology. Students implement quantum gates using a quantum simulator and present their work to their peers. (A1, A3)	
Unit 7: Entanglement and Quantum Teleportation	**5 hours**
Here, students use what they've learned thus far to design programs demonstrating quantum entanglement and quantum teleportation, running their code on quantum simulators. Students explore networking concepts in the context of quantum teleportation (A1 to A3, B1 to B5)	
Unit 8: Cyber security and ethical / security issues.	**18 hours**
In collaboration with uOttawa's Cyber-Range laboratory, students use a variety of software and programs to investigate and identify origins of real cyber-attack occurrences. Students learn how to recognize and mitigate cybersecurity issues to better protect their computers. Students investigate and share their findings and discuss ethical and security issues related to the use of computers. (A1, B4, B5, and D2)	
Unit 9: Artificial Intelligence – Final Project	**24 hours**

Artificial Intelligence may the next “industrial revolution”. It is certainly here to stay. In this unit, students learn how to recognize different AI such as chatbots, how to identify bias in AI, understand AI algorithms, and how they make decisions. Students investigate, discuss, and share their findings related to the effects of the widespread use of computers and associated technologies such as AI on society. Students then move on to create their own Machine Learning models to create their own AI device. Using a variety of software, program, file management techniques, students undertake their final project by creating AI programs. (A1, B1 to B5, and C2)	
Environment and career opportunities	8 hours
In this final unit, students will research the harmful effects of the widespread use of computers and associated technologies on the environment, as well as agencies that reduce these effects. Students will also identify various careers related to computer technology and describe the education and/or training required for them.	

Resources

No textbook is required for this course. Students will be given access to all course material in class and will be given access to software for the course to continue their learning. Students will also be given access to any equipment required for the course.

Teaching and Learning Strategies

This course is intended to give high school students a good understanding of computer technologies, the fundamentals of systems, networks and interfaces, and how they are applied through programming, quantum computing, artificial intelligence, and cybersecurity.

Students will have the opportunity to demonstrate their understanding of course concepts through rich individual tasks, group activities, projects, and informal discussions.

Group work will be a recurring theme throughout the course, allowing students an opportunity to advance their communication, problem solving, organization and collaboration skills.

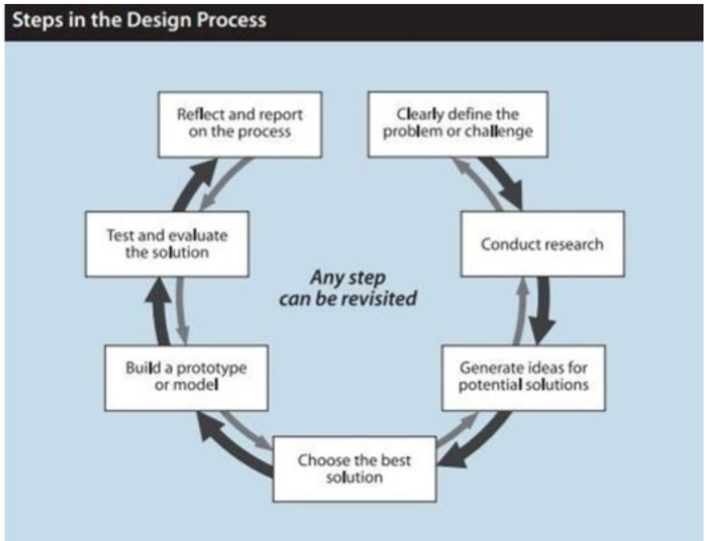
Problem Solving in Technological Education

Learning through problem solving helps students appreciate that all challenges – whether large or small, complex or simple – are most effectively resolved when approached systematically, using a simple method or a more comprehensive process, depending on the nature of the problem. Among the various problem-solving methods and approaches students may encounter in technological education include Parts Substitution, Diagnostics, Reverse Engineering, Divide and Conquer, Extreme Cases, Trial and Error. All these methods share several systematic steps – for example, identifying the problem, analyzing the situation, considering possible solutions, selecting the best solution, testing and evaluating the effectiveness of the solution, and reviewing or repeating steps as necessary to improve the solution.

The Engineering Design Process

The Engineering Design Process (EDP) is an approach to learning that emphasizes how problem solving is the best way to prepare students for the challenges they will face in the world beyond school. In the workplace, projects or tasks may not always be clearly defined or have prescribed solutions. Students who have a strong background in problem solving will be more confident and better equipped to address new challenges in a variety of contexts. In many technological fields, open-ended problem-solving processes that involve the full planning and development of products or services to meet identified needs are often referred to as the "design process". A design process involves a sequence of steps, such as the following:

- Analyze the context and background, and clearly define the problem or challenge;
- Conduct research to determine design criteria, financial or other constraints, and availability of materials;
- Generate ideas for potential solutions, using processes such as brainstorming and sketching;
- Choose the best solution;
- Build a prototype or model;
- Test and evaluate the solution;
- Repeat steps as necessary to modify the design or correct faults;
- Reflect and report on the process.



Although processes such as this involve a framework of sequential steps, they are typically iterative processes that may require a retracing of steps, diversions to solve specific problems along the way, or even a return to the start of the process if it becomes clear that the situation needs to be clarified and the problem redefined. Problem solvers soon discover that the process calls for an open mind, the freedom to be creative, and a great deal of patience and persistence.

Differentiated Instructions for different learners

Teachers at the University of Ottawa Faculty of Engineering Secondary School provide effective lesson design through differentiated instructional approaches. We plan our teaching in every subject and discipline to address the various needs of all our students and thrive for students to see themselves reflected in classroom resources and activities.

When planning instructional approaches, our priorities focus on helping our students achieve their full potential by providing a learning environment that supports not only their cognitive, emotional, social, and physical development but also promotes their healthy development, their sense of self, spirit, their mental health, and their resilience. Parents, guardians, and community partners all play critical roles in creating this educational experience.

Differentiated instruction is at the core of our curriculum planning. Differentiated instruction offers students a choice from a range of activities or allows them to select their own projects. By giving students the power to choose their own topic, they can select something that most interests them and become more invested in the project. By assessing each individual student’s abilities, background, interests and learning styles, we can design our lessons based on the needs of our diverse students. All our courses' contents (what is being taught), processes (how it is taught), and products (how students demonstrate their learning) are designed in relation to our students’ needs.

Our effective lesson designs are student centered and involve a strategic blend of whole-class, small-group, and individual learning activities to suit students' differing strengths, interests, and levels of readiness to learn.

- **We use a variety of media** to ensure that students are provided with alternatives for auditory and visual information. To support learners as they focus strategically on their learning goals, we create an environment in which learners can express themselves using a range of kinesthetic, visual, and auditory strengths.
- **We vary ways in which students can respond** and demonstrate their understanding of concepts, and support students in goal-setting, planning, and time-management skills related to their learning.
- **We use an active learning approach**, such as live coding**.** Live coding is a demonstration by the teacher in which they explain each step of the problem-solving and programming processes as students engage with these processes in real time. We occasionally deliberately introduce errors to demonstrate how to respond to such difficulties. This approach provides opportunities for students to consolidate their understanding and further develop their Engineering Design Processes skills. We pace our live coding activities with care to ensure that all students can actively participate and have time to formulate and ask questions to clarify their understanding.
- **We design assignments that are "low floor, high ceiling"** – that is, all students are provided with the opportunity to find their own entry point to the learning. We support students working at their own pace and can provide further support as needed, while continuing to move student learning forward. We design tasks that are intentionally created to be low floor, high ceiling to provide opportunities for students to use varied approaches and to continue to be engaged in learning with varied levels of complexities and challenges. This is an inclusive scaffolding approach that is grounded in a growth mindset: the belief that every student can succeed.
- **We engage in peer instruction** by involving the use of targeted multiple-choice questions with distractors that are designed to expose possible misconceptions. This is an effective technique to check for understanding and to encourage student dialogue about course topics. Our peer instruction process involves the following steps:
    1. Students investigate or practice using new concepts;
    2. The teacher poses a multiple-choice question, and students individually select their answers;
    3. Students discuss their choices with their peers, which enables them to explore the topic and possibly clarify their understanding;
    4. The teacher poses the same question again and asks each student to reassess their answer;
    5. The teacher facilitates a whole-group discussion of the topic under consideration.
- **We use the Engineering Design Process** - a model used by engineers to create something new or make something better.

- **We engage in pair programming** - a technique in which two students (a driver and a navigator) work together using a single computer to solve a problem. The driver's role is to write the code, while the navigator provides advice and guidance as they jointly work towards achieving a common goal.
- **We let students choose individual work -** where students benefit from working individually to investigate algorithms and write software programs.
- **We teach the computational thinking model**- a model of thinking that is more about thinking than it is about computing. It is about designing and evaluating potential solutions to coding problems. The concepts of computational thinking include:
    1. decomposition (the breakdown of a problem or task into steps or pieces);
    2. pattern recognition (identification of other problems or items that are similar);
    3. abstraction (the reduction of a complex task to its essential components);
    4. algorithms (a set of instructions to follow to solve a problem).

When these concepts are applied, they are known as computational thinking practices.

- **We include current events in our lessons -** current events and emerging technologies stimulate student interest and thus, are embedded in our curriculum. They enhance the relevance of the curriculum and help students connect their in-class lessons with real-world events or situations. Embedding current events into our lessons is an effective instructional strategy for implementing many course expectations.

https://www.dcp.edu.gov.on.ca/en/program-planning/considerations-for-program-planning

The Achievement Chart

Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools, First Edition, Covering Grades 1 to 12, 2010 sets out the Ministry of Education's assessment, evaluation, and reporting policy. The policy aims to maintain high standards, improve student learning, and benefit all students, parents, and teachers in elementary and secondary schools across the province.

The Achievement Chart that follows identifies four categories of knowledge and skills and four levels of achievement. in technological education. The achievement chart is a standard province-wide guide to be used by teachers. It enables teachers to make judgements about student work that are based on clear performance standards and on a body of evidence collected over time.

Categories	**50–59% (Level 1)**	**60–69% (Level 2)**	**70–79% (Level 3)**	**80–100% (Level 4)**
Knowledge and Understanding – Subject-specific content acquired in each course (knowledge), and the comprehension of its meaning and significance (understanding)				

	The Student:			
Knowledge of content (e.g., facts,equipment, terminology,materials)	demonstrates limited knowledge of content	demonstrates some knowledge of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content
Understanding of content (e.g.,procedures,technological concepts, processes,industry standards)	demonstrates limited understanding of content	demonstrates some understanding of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content
Category	**50–59% (Level 1)**	**60–69% (Level 2)**	**70–79% (Level 3)**	**80–100% (Level 4)**
Thinking – The use of critical and creative thinking skills and/or processes				
	The Student:			
Use of planning skills (e.g., identifying the problem, selecting strategies and resources, scheduling)	uses planning skills with limited effectiveness	uses planning skills with some effectiveness	uses planning skills with considerable effectiveness	uses planning skills with a high degree of effectiveness
Use of processing skills (e.g., analyzing and interpreting information, reasoning, generating and evaluating solutions, forming conclusions)	uses processing skills with limited effectiveness	uses processing skills with some effectiveness	uses processing skills with considerable effectiveness	uses processing skills with a high degree of effectiveness
Use of critical/creative thinking processes (e.g., problem-solving, design, and decision-making processes)	uses critical/ creative thinking processes with limited effectiveness	uses critical/ creative thinking processes with some effectiveness	uses critical/ creative thinking processes with considerable effectiveness	uses critical/ creative thinking processes with a high degree of effectiveness
Category	**50–59% (Level 1)**	**60–69% (Level 2)**	**70–79% (Level 3)**	**80–100% (Level 4)**
Communication – The conveying of meaning through various forms				
	The Student:			
Expression and organization of ideas and information (e.g., clear expression, logical organization) **in oral, visual, and written forms**	expresses and organizes ideas and information with limited effectiveness	expresses and organizes ideas and information with some effectiveness	expresses and organizes ideas and information with considerable effectiveness	expresses and organizes ideas and information with a high degree of effectiveness
Communication for different audiences in oral, visual, and written	communicates for different audiences and	communicates for different audiences and purposes with	communicates for different audiences and purposes with	communicates for different audiences and purposes with

forms	purposes with limited effectiveness	some effectiveness	considerable effectiveness	a high degree of effectiveness
Use of conventions (e.g., standards/symbols, units of measurement, acronyms), **vocabulary, and terminology of the discipline in oral, visual, and written forms**	uses conventions, vocabulary, and terminology with limited effectiveness	uses conventions, vocabulary, and terminology with some effectiveness	uses conventions, vocabulary, and terminology with considerable effectiveness	uses conventions, vocabulary, and terminology with a high degree of effectiveness
Category	**50–59% (Level 1)**	**60–69% (Level 2)**	**70–79% (Level 3)**	**80–100% (Level 4)**
Application – The use of knowledge and skills to make connections within and between various contexts				
	The Student:			
Application of knowledge and skills (e.g.,concepts, processes,use of equipment and technology) **in familiar contexts**	applies knowledge and skills in familiar contexts with limited effectiveness	applies knowledge and skills in familiar contexts with some effectiveness	applies knowledge and skills in familiar contexts with considerable effectiveness	applies knowledge and skills in familiar contexts with a high degree of effectiveness
Transfer of knowledge and skills (e.g., concepts, processes, use of equipment and technology) **to new contexts**	transfers knowledge and skills to new contexts with limited effectiveness	transfers knowledge and skills to new contexts with some effectiveness	transfers knowledge and skills to new contexts with considerable effectiveness	transfers knowledge and skills to new contexts with a high degree of effectiveness
Making connections within and between various contexts (e.g., between disciplines; between technology, the environment, and society; between school and future opportunities)	makes connections within and between various contexts with limited effectiveness	makes connections within and between various contexts with some effectiveness	makes connections within and between various contexts with considerable effectiveness	makes connections within and between various contexts with a high degree of effectiveness

Strategies for Assessment & Evaluation of Student Performance

Assessment, evaluation, and reporting of student achievement will be based on the policies and practices outlined in the following Ministry's policy document Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools, 2010.

Students will be evaluated based on the overall expectations of the course through the achievement charts in The Ontario Curriculum, Grades 9 and 10: Technological Education, 2009 (revised), as outlined in this document.

The Ministry of Education's document Growing Success: Assessment, Evaluation, and

Reporting in Ontario Schools outlines policies for measuring and communicating achievement.

Levels of achievement are defined as follows:

Level	Percentage	Achievement
Level 1	50-59%	Represents achievement that falls much below the provincial standard. The student demonstrates the specified knowledge and skills with limited effectiveness. Students must work at significantly improving learning in specific areas, as necessary, if they are to be successful in the next grade/course.
Level 2	60-69%	Represents achievement that approaches the provincial standard. The student demonstrates the specified knowledge and skills with some effectiveness. Students performing at this level need to work on identified learning gaps to ensure future success.
Level 3	70-79%	Represents the provincial standard for achievement. The student demonstrates the specified knowledge and skills with considerable effectiveness. Parents of students achieving at level 3 can be confident that their children will be prepared for work in subsequent grades/courses.
Level 4	80-100%	Identifies achievement that surpasses the provincial standard. The student demonstrates the specified knowledge and skills with a high degree of effectiveness. However, achievement at level 4 does not mean that the student has achieved expectations beyond those specified for the grade/course.

Mark Breakdown:

Term Work (70%) includes a variety of rich assessment tasks designed to demonstrate students' development of their knowledge and understanding, thinking and inquiry, communication and application, of all overall expectations.

Towards the end of the semester, students undertake a rich summative assessment task worth 30% of their final grade by programing a micro-computer device imbedded with Artificial Intelligence that will respond to specific needs.

Students who demonstrate evidence of achievement of overall expectations, and earn a mark of 50% or greater, will earn one credit for the course with the following exception: Students who do not complete their summative evaluation (the Final Project worth 30%) will not earn their credit regardless of their mark.

Teachers will use “assessment for learning” and “assessment as learning” practices to help students identify where they are in relation to the learning goals and what next steps they need to take to achieve the goals.

This ongoing feedback will help prepare students for “assessment of learning”, the process of collecting and interpreting evidence for the purpose of summarizing learning at a given point in time, to make judgments about the quality of student learning based on established criteria, and to assign a value to represent that quality.

Considerations for Program Planning

The Importance of Current Events in Technological Education

The discussion of current events and emerging technologies stimulates student interest and may be included in the Computer Technology curriculum. It enhances the relevance of the curriculum and helps students connect their lessons with real-world events or situations. Embedding current events into the lessons is an effective instructional strategy for implementing many course expectations into the curriculum.

The Role of ICT in Technological Education

Information and communications technologies (ICT) tools allow teachers to expand their instructional strategies and support student learning. These tools include Internet websites, Youtube videos, slideshows, class forums and other multimedia resources. These tools help students collect, organize, and present data for reports and presentations. They also enable students to connect with each other and the world to be able to share ideas and collaborate on learning.

Students will be encouraged to use ICT tools for most of the course in order to learn new skills and communicate their learning. Students will have the choice of technologies they use for delivering their presentations on the impact of computers on society and to present their final app design projects to the class.

With the power of the Internet comes potential risks such as privacy, safety, and abuse of technology in the form of bullying or other malicious acts. Students must be made aware of these issues and teachers will model appropriate behaviour in their instruction. Teachers can also make use of ICT tools in their day-to-day teaching practice of curriculum design and in-class teaching.

Planning Technological Education Programs for Students with Special Education Needs

Teachers have a duty to ensure that all students in their class have the opportunity to learn and succeed regardless of their special education needs. *Special Education Transformation: The Report of the Co-Chairs with the Recommendations of the Working Table on Special Education, 2006* promotes a set of beliefs that should guide program planning for students with special education. These beliefs include:

- All students can succeed.
- Universal design and differentiated instruction are effective and interconnected means of meeting the learning or productivity needs of any group of students.
- Each student has his or her own unique patterns of learning.
- Teachers need the support of the larger community to create a learning environment that supports students with special education needs.
- Fairness is not sameness.

Teachers are encouraged to develop their program plan in accordance to their students' diversity of strengths and abilities. This can be achieved through a myriad of ways including: assessing each student's prior knowledge and skills, providing ongoing assessment, and allowing for flexible groupings. By assessing each student's current achievement level and weighing that against the course expectations, the teacher can determine if the student will be requiring any combination of: accommodations, modified expectations, or alternative expectations. If the student requires accommodations, modified expectations, or both, the information must be recorded in their Individual Education Plan (IEP).

Students Requiring Accommodations Only

Accommodations that are required by students must be identified on their IEP. Differentiated instruction and universal design lend themselves well to providing accommodations for students. Students will still be evaluated on the curriculum course expectations and achievement levels communicated by the Ministry.

There are three types of accommodations:

- Instructional accommodations: Teachers change the way in which lessons are taught including integrating technology and using different styles of presentation.
- Environmental accommodations: This includes a change in the learning environment whether it be classroom seating by location or group, or lighting.
- Assessment accommodations: These allow students to demonstrate their learning in a different way. For instance, they may be given the opportunity to give oral answers to written questions or they may be given more time to complete an assignment or test.

Students Requiring Modified Expectations

Modified expectations that are required by students must be identified on their IEP. For the most part, these expectations will be based on the regular course expectations, but the number and/or complexity will differ. Modified expectations are specific, realistic, and measurable achievements that the student can demonstrate independently, given assessment accommodations.

It is the principal who will decide whether the achievement of the modified expectations constitutes successful completion of the course and whether the student is eligible to receive a credit for the course; this decision must be communicated to the student and their parents.

When course expectations are not extensively modified and it is expected that the student can achieve most of them, the modified expectations should determine how the required knowledge and skills differ from those identified in the course expectations. In the case, if the student is working toward a credit for the course, the IEP box must be checked on the Provincial Report Card.

With extensive modifications to expectations such that achievement of them is not expected to result in a credit, the expectations should identify the precise requirements or tasks on which the student's performance will be evaluated and which will be used to determine the student's mark on the Provincial Report Card. The IEP box must be checked and the appropriate statement from the *Guide to the Provincial Report Card, Grades 9-12, 1999* (p. 8) must be added. Modified expectations must be reviewed in relation to the student's progress at least once each reporting period and must be updated as necessary.

Program Considerations for English Language Learners

Schools in Ontario have a very diverse and multicultural student population, such that 20% of students have a language other than English as their first language. These English language learners may be recent immigrants or refugees while others may be born in Canada into a family whose primary home language is either not English or is an English dialect differing significantly from the English taught in Ontario schools. Teachers must be mindful that many of these students are entering a new linguistic and cultural environment at school.

During their first few years in an Ontario school, English language learners may receive support through English as a Second Language (ESL) programs or English Literacy Development (ELD) programs. ELD programs are primarily for newcomers who arrive with significant gaps in their education, often due to limited opportunities (in terms of education and literacy) in their home country.

It is important that teachers recognize the orientation process whereby English language learners adapt to a new social environment and language. Some may be very quiet at first, using body language rather than speech and/or limited verbal communication to convey their thoughts. These students thrive in a safe, supportive, and welcoming environment. As the students learn to speak English, it is important to note that oral fluency is not a good indicator of the student's literacy development and vocabulary.

It is the shared responsibility of the classroom teacher, the ESL/ELD teacher (where available), and other school staff to help in the development of students' English. Volunteers and peers may also provide significant support. Teachers are required to adapt their instruction to facilitate the success of their English language learner students. These adaptations may include:

- Modifying some or all course expectations such that they are challenging yet achievable given the student's English proficiency
- Using a variety of instruction strategies, such as visual cues, pre-teaching vocabulary, offering peer tutoring
- Using a variety of learning resources, such as bilingual dictionaries, visual material, simplified text
- Modifying assessments, such as giving extra time, offering the choice of demonstrating skills/knowledge orally or in writing, assigning cloze sentences instead of essays

When learning expectations are modified for an English language learner, it must be clearly indicated on their report card.

Equity and Inclusion Education in Technological Education

The Faculty of Engineering Secondary School abides by the University of Ottawa's Violence Prevention Policy and Prevention of Harassment and Discrimination Policy. These policies encourage staff and students to show respect for diversity in the school and the wider society. The policies aim to provide a safe learning environment, free from violence, harassment, and discrimination.

Differentiated instruction will be at the core of curriculum planning. By assessing each individual student's abilities, background, interests and learning styles, teachers can design their lessons based on the needs of their diverse students. The course content (what is being taught), process (how it is taught), and product (how students demonstrate their learning) will be designed in relation to the students' needs.

Generally, in technical courses such as computer science there is a clear gender disparity. Studies have shown that female students are often drawn to courses that have a societal aspect to them, rather than just abstract learning. It may be helpful for teachers to offer projects and activities that have a clear and meaningful societal application. For instance, instead of being asked to design a robotic arm (whose purpose is unknown), teachers can give students the option of designing an assistive device. Differentiated instruction offers students a choice from a range of activities or allows them to select their own projects; by giving students the power to choose their own topic, they can select something that most interests them and become more invested in the project.

Environmental Education in Technological Education

It is important for students to understand their environmental impact in the world and how they can better the environment they are living in. It is the duty of the teacher to integrate environmental education into their curriculum planning such that students understand their personal responsibility to the environment and their role in society.

Environmental education can be integrated into the classroom in a variety of ways. In selecting their projects, students can go the environmental route and select a project that is directly linked to environmental impact, such as a simulation of a healthy ecosystem. Additionally, students can focus on the environmental impact of computer use by learning about the safe handling and disposal of materials used in the manufacturing of computer components. By implementing strategies to reduce, reuse and recycle, students can learn about government agencies and community partners that support such practices. This will give students the opportunity to develop critical thinking skills and responsible practice with respect to environmental implications of their selected project.

Programming projects can be used to address environmental-focused course expectations. For instance, students can program a survey that assesses people's environmental awareness as it relates to the use of computers. The program could calculate the awareness and suggest strategies or provide feedback to users.

Literacy, Mathematical Literacy, Financial Literacy, and Inquiry/Research Skills

Many activities in the computer studies curriculum requires students to practice and develop oral, written, and visual literacy skills. Students will be required to brainstorm ideas and effectively communicate them to their team members. They will need to be able to justify their choices for decisions taken in the design process and will need to be able to communicate them clearly to their audience in an oral presentation with visual support. They will be required to compose written reports on their progress and outline the steps taken during the design process in order to effectively convey their message to the reader. Students will be learning specialized terminology which they will be expected to use appropriately and precisely in their communication.

In developing programs, students will build on their mathematical literacy. Students will be required to communicate clearly and concisely through the use of tables, diagrams, and/or flow charts. Many components of the computer technology curriculum emphasize students' ability to interpret and use symbols and charts.

While learning about the different components of a computer, both hardware, software, and operating system, students will understand the importance of making good economical choices when choosing or buying a computer. Financial literacy connections may be made as students learn about their place in the world, as a responsible and compassionate citizen and through critical thinking, decision-making and problem solving that can be applied to real life situations.

In conducting research for their projects, students will be required to explore a variety of possible solutions to their challenge, analysing the context of their data and properly interpreting it. They will be required to analyse the source of their information, determine its validity and relevance, and use it in appropriate ways. Teachers can support students by guiding them toward reputable sources including peer-reviewed journals. The ability to locate, question, and evaluate information allows a student to become an independent, lifelong learner.

The Ontario Skills Passport and Essential Skills

The Ontario Skills Passport (OSP) is a web-based service that can track students' Essential Skills (such as reading, writing, and problem solving) and work habits (such as working safely and being reliable). These skills and work habits are easily transferable from school to work and are useful for employers looking to assess potential candidates for cooperative education placements. The OSP is also useful for students looking to assess, build, document, and track their skills through their educational, professional, and personal experiences. More information about the OSP can be found on the ministry website, http://skills.edu.gov.on.ca.

The Ontario First Nation, Métis, Inuit Education Policy Framework

The Ontario First Nation, Métis, and Inuit Education Policy Framework is based on the vision that all First Nation, Métis and Inuit students in Ontario will have the knowledge, skills and confidence they need to successfully complete their secondary education to pursue postsecondary education or training and/or to enter the workforce. They will have the traditional and contemporary knowledge, skills, and attitudes required to be socially contributive, politically active, and economically prosperous citizens of the world. All students in Ontario will have knowledge and appreciation of contemporary and traditional First Nation, Métis, and Inuit traditions, cultures, and perspectives.

The Faculty of Engineering Secondary School abides by the goals stated in the Ontario First Nation, Métis, and Inuit Education Policy Framework to provide a supportive and safe environment for all FNMI students. These goals include:

- Increase the level of student achievement
- Reduce gaps in student achievement
- Increase the levels of public confidence

For example, the school will strive to develop awareness among teachers of the learning styles of First Nation, Métis, and Inuit students and instructional methods designed to enhance the learning of students, such as incorporating meaningful First Nation, Métis, and Inuit cultural perspectives and activities when planning instruction, and implementing strategies for developing critical and creative thinking.

The First Nation, Métis, and Inuit students will also have access to the support, activities and resources offered by the uOttawa Indigenous Resource Centre Mashkawazìwogaming. For

example, students can have access to student mentoring from a university student, individual or group meeting with and Elder in residence, and social and cultural events to participate in, if they wish to.
The Faculty of Engineering Secondary School, as part as the University of Ottawa also supports the uOttawa Indigenous Action Plan Framework for 2019-2024 which is designed to facilitate the inclusion of First Nation, Métis, and Inuit students and support the specific needs of the indigenous community.

Career Education

In this era of technological innovation with rapidly evolving technologies, employers are always on the lookout for candidates with strong technical skills who can problem-solve effectively, think critically, and work collaboratively. These are the exact skills that will be developed through computer studies courses. In going through the design process, students will develop skills in: research, analysis, creativity, problem-solving, design, and presenting. They will practice these skills through both independent and group work.

Cooperative Education and Other Forms of Experiential Learning

Cooperative education and other forms of experiential learning, such as job shadowing, work experience, and field trips, allow students to apply the skills they've learned in the classroom to real-word work environments. They help students learn about the possible careers and employment opportunities in various fields of work, as well as broadening their knowledge of workplace practices and employer-employee relationships.

Students who choose a computer studies course as the related course for two cooperative education credits are able, through this packaged program, to meet the group 1, 2, and 3 compulsory credit requirements for the OSSD.

Teachers must assess the health and safety of placements and ensure that their students understand their rights as they relate to health and safety, privacy and confidentiality, and abuse and harassment in the workplace.

All cooperative education and other workplace experiences will be provided in accordance with the ministry's policy document *Cooperative Education and Other Forms of Experiential Learning: Policies and Procedures for Ontario Secondary Schools, 2000*.

Health and Safety in Technological Education

The most common health and safety concerns associated with repeated computer use are eye strain and musculoskeletal injuries (including repetitive strain injuries). Teachers will ensure that work stations are ergonomic and that students maintain good posture and take frequent eye and body breaks. Students will also be taught about emotional and health risks common among heavy computer users, particularly social isolation.

Students will be trained on how to safely use all technological equipment required for the class, particularly microcontrollers. Teachers will model proper procedures and safe practices, warning students of possible dangers inherent in using the equipment. Students must be able to demonstrate knowledge of how the equipment is used and what procedures must be followed to ensure its safe use.
Any practice will comply with relevant health and safety regulations including, but not limited to:

- the Ontario Workplace Safety and Insurance Act
- the Workplace Hazardous Materials Information System (WHMIS)
- the Food and Drugs Act
- the Ontario Health Protection and Promotion Act
- the Ontario Building Code
- the Occupational Health and Safety Act
- local by-laws

While teachers are responsible for their students' safety during a technology lab, they will encourage students to take responsibility of their own safety and that of others. They will support students in developing the knowledge and skills required to stay safe and maintain a safe learning environment for all students.