TEJ4M0
Computer Engineering Technology

Overview

Grade 12 Computer Engineering Technology continues the study of computer systems and robotics introduced in TER3M0. Topics to be covered include: microprocessors, binary arithmetic, sequential logic circuits, networking, programming, and careers in computer engineering.

Achievement

The Grade 12 curriculum in Computer Engineering Technology is prescribed by the Ontario Ministry of Education. Major projects will be assessed using a rubric, a detailed list of the evaluation criteria and performance expectations. Study the rubric carefully, as it indicates what learning and skills you are expected to demonstrate. All criteria will fall within one of the four categories (Thinking, Application, Communication, Knowledge) on which your mark will be based.

The final evaluation will constitute 30 percent of the mark. One component of the final evaluation will be a written examination.

Evaluation

The marks categories will be weighted as follows:

Thinking	20%
Application	40%
Communication	20%
Knowledge	20%

Term work and final evaluation are weighted as follows:

Term:	70%
Practical and Written Exam:	30%

Activities

- Students will learn about Boolean algebra and the operation of sequential logic circuits (flip-flops), including counters and memory circuits.
- Students will study the structure of microprocessors and write low-level assembly language programs.
- Students will simulate the operation of complex digital electronic circuits using computer software (Crocodile Physics).
- Students will assemble integrated circuits using breadboards or printed circuit boards. Students will learn the use of electronic test equipment including digital multimeters and oscilloscopes.
- Students will build robots controlled by microcontrollers and guided by sensors.

General Expectations

As grade 12 students, you will soon be graduating and moving on to employment or further education. At work or at post-secondary educational institutions, it is expected that you will be self-motivated and self-disciplined. After three years in secondary school, it is expected that you are beginning to develop these qualities. In this course, you will be given many opportunities to explore your own interests in the field of computer engineering, but you will also be expected to take responsibility for pursuing and completing those interests. Many of the projects will require that you undertake considerable independent research outside of class time. You will be expected to present the results of your projects in a well-documented and "professional" format.

Safety and Decorum

The computer engineering classroom has a number of hazards, both electrical and chemical, which you will be made aware of. It is important that you follow all safety rules for your own safety and that of your classmates. You are expected to act in a mature and responsible manner befitting senior students at all times.

Stern Words About the Use and Abuse of Equipment

Equipment and resources within the department are available for your use, but they are not your property. You are granted access on the condition that you accept responsibility for its care and appropriate use. Misuse or abuse of the classroom equipment will result in appropriate consequences.

Attendance and Participation

Many learning activities in this course involve making something in a cooperative way. In cases where it is clear that not all students contributed equally to the group project, the marks will be distributed appropriately. If you are unavoidably absent due to illness or other legitimate reason, you may make up for lost time by arrangement with the instructor.

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Unit 1: Review

Time: 7.5 hours
Key concepts introduced in TER3M0 will be reviewed, as they are fundamental to further studies. These concepts include binary numbering systems, Boolean logic gates, and electronic circuitry.

Unit 2: Sequential Logic Circuits

Time: 15 hours
In TER3M0, the study of digital logic is limited to combinational logic circuits: these are circuits which depend solely on the state of the inputs at a given time. An AND gate for example is only on when both inputs are high. The operation of computers, however, depends on sequential logic circuits, that is, circuits with memory, in which current states are dependent on previous events. The logic circuit which makes memory and sequencing possible is the Flip-Flop; it is used in conjunction with oscillator circuits, which provide the timing or clock pulses. Students will learn to combine these basic circuits to create counters, registers, and control systems.

Unit 3: Electronics

Time:15 hours
Students will apply their knowledge of Flip-Flops and oscillators in creating electronic circuits. Circuits will first be simulated on the classroom computers using the software package Crocodile Physics. Students will also build and test logic circuits using integrated circuits in the electronics lab. We will study the function and application of various sensors. Students will learn how to build circuits that can control devices such as electric motors while also protecting the control device from large currents. Emphasis will be placed on correct and safe procedures for the use of electronic equipment

Unit 4: Microcontrollers

Time: 15 hours
In this unit, students will undertake a detailed analysis of the structure and operation and manufacture of the central component of modern computer systems: microprocessors. Students will explore the various units that make up the microprocessor, how they process instructions, and how they are connected to memory, inputs and outputs. We will apply this general knowledge to the programming and application of microcontrollers using both assembly language and higher level languages.

Unit 5: Robotics and Computer Programming

Time: 30 hours
Students will apply the knowledge they have developed in electronics and computer systems to the building of robots. utilizing 8-bit Microcontrollers. Microcontrollers are integrated circuits which contain a complete microprocessor and a programmable ROM which contains the machine language program. The programming in this course will focus on the writing of assembly language programs which can be downloaded to the Microcontroller through a serial cable or a USB cable.

Unit 6: Networking

Time: 12.5 hours
In TER3M0, students gained an understanding of the components necessary to set up a simple peer-to-peer network. In this unit we will explore the components necessary for larger and more complex networks. Topics covered will include servers, routers, protocols and advanced cabling techniques.

Unit 7: Technology, the Environment and Society

Time: 7.5 hours
Computer technology is constantly changing. In this unit, students will explore the latest developments in computing technology and promising fields for future breakthroughs. Students will research topics and share their findings with the class. The implications of the new discoveries on the individual, on society, and on the environment will be discussed. Questions relating to the acceptable and ethical use of computers will also be examined.

Unit 8: Professional Practice and Career Opportunities

Time: 7.5 hours
Since we will be working with power tools, soldering irons and electrical power, safety is a priority, and students will learn safe working procedures. Students will also have the opportunity to identify job possibilities in computer engineering and the educational requirements necessary to pursue those opportunities.