Ontario

Computer Engineering Technology Program Standard

The approved program standard for Computer Engineering Technology programs of instruction leading to an Ontario College Advanced Diploma delivered by Ontario Colleges of Applied Arts and Technology.

(MTCU funding code 60509)

Ministry of Training, Colleges and Universities
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Introduction

This document is the Program Standard for the Computer Engineering Technology programs of instruction leading to an Ontario College Advanced Diploma delivered by Ontario Colleges of Applied Arts and Technology (MTCU funding code 60509).

Development of system-wide program standards

In 1993, the Government of Ontario initiated program standards development with the objectives of bringing a greater degree of consistency to college programming offered across the province, broadening the focus of college programs to ensure graduates have the skills to be flexible and to continue to learn and adapt, and providing public accountability for the quality and relevance of college programs.

The Program Standards Unit of the Ministry of Training, Colleges and Universities has responsibility for the development, review and approval of system-wide standards for programs of instruction at Ontario Colleges of Applied Arts and Technology.

Program standards

Program standards apply to all similar programs of instruction offered by colleges across the province. Each program standard for a postsecondary program includes the following elements:

- **Vocational standard** (the vocationally specific learning outcomes which apply to the program of instruction in question),
- **Essential employability skills** (the essential employability skills learning outcomes which apply to all programs of instruction); and
- **General education requirement** (the requirement for general education in postsecondary programs of instruction).

Collectively, these elements outline the essential skills and knowledge that a student must reliably demonstrate in order to graduate from the program.

Individual Colleges of Applied Arts and Technology offering the program of instruction determine the specific program structure, delivery methods and other curriculum matters to be used in assisting students to achieve the outcomes articulated in the standard. Individual colleges also determine whether additional local learning outcomes will be required to reflect specific local needs and/or interests.

The expression of program standards as vocational learning outcomes

Vocational learning outcomes represent culminating demonstrations of learning and achievement. They are not simply a listing of discrete skills, nor broad statements of knowledge and comprehension. In addition, vocational learning outcomes are interrelated and cannot be viewed in isolation from one another. As such, they should be viewed as a comprehensive whole. They describe performances that demonstrate that significant integrated learning by graduates of the program has been achieved and verified.

Expressing standards as vocational learning outcomes ensures consistency in the outcomes for program graduates, while leaving to the discretion of individual colleges, curriculum matters such as the specific program structure and delivery methods.

The presentation of the vocational learning outcomes

The **vocational learning outcome** statements set out the culminating demonstration of learning and achievement that the student must reliably demonstrate before graduation.

The **elements of the performance** for each outcome define and clarify the level and quality of performance necessary to meet the requirements of the vocational learning outcome. However, it is the performance of the vocational learning outcome itself on which students are evaluated. The elements of performance are indicators of the means by which the student may proceed to satisfactory performance of the vocational learning outcome. The elements of performance do not stand alone but rather in reference to the vocational learning outcome of which they form a part.

The development of a program standard

In establishing the standards development initiative, the Government determined that all postsecondary programs of instruction should include vocational skills coupled with a broader set of essential skills. This combination is considered critical to ensuring that college graduates have the skills required to be successful both upon graduation from the college program and throughout their working and personal lives.

A program standard is developed through a broad consultation process involving a range of stakeholders with a direct interest in the program area, including employers, professional associations, universities, secondary schools and program graduates working in the field, in addition to students, faculty and administrators at the colleges themselves. It represents a consensus of participating stakeholders on the essential learning that all program graduates should have achieved.

Updating the program standard

The Ministry of Training, Colleges and Universities will undertake regular reviews of the vocational learning outcomes for this program to ensure that the Computer Engineering Technology Program Standard remains appropriate and relevant to the needs of students and employers across the Province of Ontario. To confirm that this document is the most up-to-date release, please contact the ministry:

psu@ontario.ca

Vocational standard

All graduates of Computer Engineering Technology programs have achieved the fourteen vocational learning outcomes (VLOs), in addition to achieving the essential employability outcomes and meeting the general education (GE) requirement.

Preamble

Increasingly, individuals and organizations look to computers, be they stand-alone or networked, to optimize workflow, establish a presence in global markets, and improve communication. This pervasive integration of computers and their associated technologies has led to an emergence of job opportunities in the creation, integration, and support of technology systems and infrastructures.

Ontario Colleges of Applied Arts and Technology offer a wide variety of computer-related programs that prepare graduates for both existing and emerging opportunities in our society. At the heart of the computer technology education provided to Ontario college students is the ability to think critically, solve problems, and acquire new skills quickly. While these abilities are practised and enhanced in the context of a particular expertise, they are also transportable, with a reasonable training period, to other areas of expertise involving computers and their associated technologies.

Graduates of Computer Engineering Technology programs have acquired the knowledge and practical experience to continue to extend the application and ubiquitous nature of computing technology into our daily lives. As such, graduates are able to work individually or as part of a team to analyze, design, implement, and maintain software, embedded devices and hardware. From integrating existing components to building new ones, graduates work in a broad range of employment settings within the Computing sector in both large and small organizations, as well as in any environment that relies on the advantages of computer systems.

Recently Computer Engineering Technology graduates have been hired into the following positions including: computer programmers and interactive media developers, user support technicians, computer network technicians, and information systems analysts and consultants.

While the vocational learning outcomes for programs, such as Computer Engineering Technician, articulate the depth and breadth of skills, knowledge, and attitudes required by graduates when entering the work force, individual college programs may choose to build on this standard by offering some degree of specialization. Irrespective of the specialization, graduates' learning is significantly enhanced by opportunities for as much practical experience as is feasible during their time in the program.

There are many opportunities for graduates to pursue further educational qualifications; graduates may be granted credits towards a degree or certification, either through

articulation agreements between the colleges and universities or by direct credit transfer. Students should contact individual colleges for further details of a college's articulation agreements or credit transfer possibilities.

To be successful in the computing environment requires an ongoing commitment from the graduate to continue to update their skills to stay current in this rapidly changing field. Making use of knowledge and experience gained during their studies, graduates may also choose to apply for professional designations from provincial, national, and international organizations as a further demonstration of their commitment to keep their skills current.

Note: The Ontario Council on Articulation and Transfer (ONCAT) maintains the provincial postsecondary credit transfer portal, ONTransfer.

Synopsis of the vocational learning outcomes

Computer Engineering Technology (Ontario College Advanced Diploma)

Vocational Learning Outcomes (VLOs) 1 to 9 are common core outcomes that apply to all programs in the MTCU codes; 60503, 60504, 60505, and 60509. VLOs 10 to 14 are outcomes that relate specifically to Computer Engineering Technology programs.

The graduate has reliably demonstrated the ability to:

1. identify, analyze, design, develop, implement, verify and document the requirements for a computing environment.

2. diagnose, troubleshoot, document and monitor technical problems using appropriate methodologies and tools.

3. analyze, design, implement and maintain secure computing environments.

4. analyze, develop and maintain robust computing system solutions through validation testing and industry best practices.

5. communicate and collaborate with team members and stakeholders to ensure effective working relationship.

6. select and apply strategies for personal and professional development to enhance work performance.

7. apply project management principles and tools when responding to requirements and monitoring projects within a computing environment.

8. adhere to ethical, social media, legal, regulatory and economic requirements and/or principles in the development and management of the computing solutions and systems.

9. investigate emerging trends to respond to technical challenges.

10. integrate multiple software and hardware components using appropriate systems, methodologies, and connection protocols.

11. analyze, plan, design, develop, test, and implement computing devices and networked systems (software or hardware) in accordance with appropriate functional requirements and standards.

12. apply principles of digital and analog circuits to design, implement, and troubleshoot computing devices, including embedded components and systems.

13. design, build, test, implement, and maintain embedded (including **IoT***) devices and applications.

14. develop, test and maintain software applications for systems integration.

* See List of Abbreviations

Note: The learning outcomes have been numbered as a point of reference; numbering does not imply prioritization, sequencing, nor weighting of significance.

The vocational learning outcomes

1. The graduate has reliably demonstrated the ability to: identify, analyze, design, develop, implement, verify and document the requirements for a computing environment.

Elements of the performance

a. Recognize the advantages and disadvantages of various network structures and protocols in the design of a solution.
b. Apply knowledge of a variety of analysis, design, and development concepts and methodologies.
c. Analyze, design, develop, and maintain effective user interfaces.
d. Prepare, present, and maintain current, clear, and accurate documentation.
e. Apply industry standard tools to produce documentation of hardware/software design.
f. Apply an understanding of requirements determination and requirements gathering techniques to computing tasks.

2. The graduate has reliably demonstrated the ability to: diagnose, troubleshoot, document and monitor technical problems using appropriate methodologies and tools.

Elements of the performance

a. Formulate troubleshooting procedures taking into account the problem and the environment.
b. Document procedures and policies for keeping security systems up-to-date.
c. Monitor, review, and assess the effectiveness of the troubleshooting procedure.
d. Document the troubleshooting procedure clearly.
e. Establish and follow troubleshooting procedures and explain them clearly to others.
f. Assess the impacts of the environment (e.g. hardware, software, operating system) on the installation and customization of computing systems.
g. Document clearly the design conditions for the implementation and configuration of a solution.
h. Analyze and apply the various communication protocols and connectivity options in a solution/system.

3. The graduate has reliably demonstrated the ability to: analyze, design, implement and maintain secure computing environments.

Elements of the performance

a. Discuss basic elements and relationships between business continuity management and **ICT*** disaster recovery.
b. Analyze and evaluate the results of risk assessment and business impact analysis to recoverability design and recovery prioritization to define the order of recovery based upon defined business recovery needs.
c. Evaluate backup and recovery solutions in relation to business and organizational needs.
d. Apply knowledge of incident identification, evaluation and management to increase security and recoverability of applied computing environments e.g. networks, data, and applications.
e. Document recovery plans and test concepts.
f. Develop and maintain appropriate security solutions for the protection of computing systems
g. Conduct recovery tests, maintain and update plans.
h. Design, develop, and test computing systems with respect to security against intrusion and the protection of data.
i. Incorporate industry-standard security into the development of program code.
j. Conduct identification and assessment of vulnerabilities in deployed IT systems.

* See List of Abbreviations

4. The graduate has reliably demonstrated the ability to: analyze, develop and maintain robust computing system solutions through validation testing and industry best practices.

Elements of the performance

a. Minimize risks to clients when deploying computing system solutions, by contributing to risk analysis.
b. Apply knowledge of a variety of techniques to test and debug computing solutions.
c. Select appropriate testing methodologies based on specifications, and document results of tests.
d. Develop and organize unit and integration testing.
e. Prepare, complete and supervise systems tests, including user acceptance tests.
f. Evaluate various security risks and mitigations to assure the protection of the client computing solution
g. Apply test driven development techniques in the development of computing systems.

5. The graduate has reliably demonstrated the ability to: communicate and collaborate with team members and stakeholders to ensure effective working relationships.

Elements of the performance

a. Identify strategies for communication success in academic, personal and career areas in order to develop and maintain effective working relationships.
b. Facilitate communication and workflow among project team members including online chat, video-conferencing or collaborative document production.
c. Use appropriate language, terminology and etiquette in both face–to-face and electronic communication with team members and stakeholders.
d. Investigate, plan and create documents for computing requirements, by applying critical thinking skills.
e. Create effective messages, both oral and written, that accurately reflect the audience and the purpose.
f. Gather and analyze information from a variety of sources to assist in analyzing communication and business situations.
g. Document sources using appropriate writing protocols for technical communication.
h. Create effective reports, presentations and charts, to convey applicable project information to team members and stakeholders.
i. Use collaborative tools specific to development.

6. The graduate has reliably demonstrated the ability to: select and apply strategies for personal and professional development to enhance work performance.

Elements of the performance

a. Seek out and utilize external resources, including mentors, to support one's own learning goals.
b. Exercise critical thinking skills when attempting to repurpose solutions searching for information from various sources, including to applied computing problems found on the Internet.
c. Provide mutual support and feedback to peers using online sharing and communication tools.
d. Recognize personal limits and seek assistance in a timely manner to resolve problems beyond one's own knowledge and skills.
e. Identify and utilize various forms of content media in the pursuit of professional development.
f. Recognize learning needs and develop adaptive strategies to expand one's personal and professional knowledge.
g. Identify appropriate professional/trade organizations that support personal and professional development.
h. Remain current with relevant technological change that could have an impact on the workplace.
i. Identify appropriate information related to quality programs, practices, processes, and procedures which apply to the computing environment e.g. from **ISO***, **IEEE***, **ACM***, **CTAB***, **TAC***, **CIPS***.

* See List of Abbreviations

7. The graduate has reliably demonstrated the ability to: apply project management principles and tools when responding to requirements and monitoring projects within a computing environment.

Elements of the performance

a. Participate in the planning, identification, scheduling, and assigning of tasks and resources involved in a project as required.
b. Monitor resources and expenditures to maintain cost effectiveness and timelines of a project.
c. Consolidate project updates at regular intervals.
d. Estimate accurately the time and cost required to complete project elements.
e. Complete project elements according to schedule.
f. Interpret and use relevant project planning documents and tools.
g. Identify problems that will affect the project timeline, and recommend changes, as soon as possible.
h. Maintain current, clear, and accurate project-related documents which adhere to organizational and industry standards and procedures.
i. Select and use project management software effectively for various types of projects.
j. Manage and control the changing requirements throughout the life cycle of a project.

8. The graduate has reliably demonstrated the ability to: adhere to ethical, social media, legal, regulatory and economic requirements and/or principles in the development and management of the computing solutions and systems.

Elements of the performance

a. Identify special issues or constraints around projects regarding ethical, social, legal, regulatory and economic considerations.
b. Research and report on ethical, social, legal, regulatory and economic considerations within the computing industry.
c. Adhere to and advocate for ethical principles and standards.
d. Apply knowledge of existing confidentiality, privacy, and reporting regulations to daily work.
e. Comply with licensing requirements.
f. Comprehend and apply guidelines from various computing sources that prescribe quality programs, practices, processes, and procedures.
g. Maintain professional and honest relationships with stakeholders.
h. Evaluate the ethical implications of information handling within computing solutions and systems.
i. Discuss the ethical issues related to current and emerging technologies, such as Artificial Intelligence, data ownership, data privacy, etc. and comply with legislative and workplace policies, and, if applicable, suggest appropriate changes.
j. Apply knowledge of confidentiality and privacy regulations, e.g. **FIPPA*** and other pertinent regulatory frameworks and/or compliancy requirements that apply to personal information collection, storage and distribution.
k. Discuss social media expectations, opportunities, limitations, risks, protocols and accepted practice.

* See List of Abbreviations

9. The graduate has reliably demonstrated the ability to: investigate emerging trends to respond to technical challenges.

Elements of the performance

a. Select characteristic and significant examples of advanced technology concepts from emerging areas of information computing technologies.
b. Present novel technologies to computing professionals and others.
c. Relate applications of novel computing technologies to existing business and technical problems.
d. Present a case for the adoption of an emerging technology within an established applied computing environment.
e. Develop instructional presentations, including demonstrations of emerging technologies.
f. Report on defining technical aspects of emerging technologies.

10. The graduate has reliably demonstrated the ability to: integrate multiple software and hardware components using appropriate systems, methodologies, and the various connection protocols.

Elements of the performance

a. Apply appropriate principles of software and hardware integration (e.g. **RFID*** systems, smart card readers, biometric security systems, **IoT***-based sensing and response systems), when integrating software and hardware components.
b. Apply principles of a variety of control systems and processes as required (e.g. robotics, point of sale systems, process control, sequential control, smart city or smart building systems), when integrating software and hardware components.
c. Adapt and integrate network (Profinet, Ethernet, Controlnet, **TCP/IP***, etc.) stacks as required for communication with remote devices and applications.
d. Apply basic principles of firmware integration for software and hardware components.
e. Apply knowledge of device connectivity, networks and communications technology, when integrating software and hardware components.
f. Identify, assess and select the appropriate protocol and topology for a communication system.
g. Apply knowledge of security protocols and procedures when integrating software and hardware components.
h. Resolve interoperability issues affecting the integration of software and hardware components.

* See List of Abbreviations

11. The graduate has reliably demonstrated the ability to: analyze, plan, design, develop, test, and implement computing devices and networked systems (software or hardware) in accordance with appropriate functional requirements and standards.

Elements of the performance

a. Conduct a needs assessment in determining the requirements for computing/networking devices and systems.
b. Develop functional specification for computing/networking devices and systems.
c. Design infrastructure, applications, and hardware according to appropriate standards.
d. Incorporate and apply appropriate electrical interfacing and timing techniques into the design, development and testing of computing/networking devices.
e. Incorporate product lifecycle considerations in the design of computing devices and networked systems (software or hardware).
f. Justify computing/networking device design and implementation decisions in compliance with appropriate standards and requirements.
g. Document the development, testing and implementation of a computing/networking system according to required standards.

12. The graduate has reliably demonstrated the ability to: apply principles of digital and analog circuits to design, implement, and troubleshoot computing devices, including embedded components and systems.

Elements of the performance

a. Apply appropriate digital circuit principles in the design and implementation of computing devices, including embedded components and systems.
b. Apply appropriate analog circuit principles in the design and implementation of computing devices, including embedded components and systems.
c. Troubleshoot, diagnose and repair computing devices, including embedded components and systems using appropriate tools and procedures.
d. Prepare, modify and interpret circuit diagrams associated with computing devices, including embedded components and systems.
e. Assess and interpret the electrical requirements of computing devices, including embedded components and systems.
f. Design and implement analog-to-digital, and digital-to-analog conversion interfaces as required.
g. Use automated test and measurement techniques to assess the characteristics and performance of computing devices, including embedded components and systems.
h. Document and summarize results and procedures.
i. Apply circuit schematic capture and **PCB*** design using an **ECAD*** package.

* See List of Abbreviations

13. The graduate has reliably demonstrated the ability to: design, build, test, implement, and maintain embedded (including **IoT***) devices and applications.

Elements of the performance

a. Design, develop, test and implement embedded (including **IoT***) devices for real-world environments.
b. Evaluate embedded (including **IoT***) applications and identify requirements.
c. Define functional requirements for embedded (including **IoT***) applications.
d. Design **IoT*** infrastructure, applications, and hardware according to appropriate standards.
e. Apply knowledge of electrical interfacing and timing in the design and development of embedded (including **IoT***) devices.
f. Incorporate appropriate power consumption and lifespan features into the design and implementation of embedded (including **IoT***) devices.
g. Justify embedded (including **IoT***) device design and implementation decisions in compliance with appropriate standards and requirements.
h. Document the development and implementation of embedded (including **IoT***) devices according to required standards.

* See List of Abbreviations

14. The graduate has reliably demonstrated the ability to: develop, test and maintain software applications for systems integration.

Elements of the performance

a. Apply knowledge of multiple programming languages to the selection of an appropriate language for a given application.
b. Select and use an appropriate software development platform and program design methodology for a given application.
c. Apply knowledge of source-code and version control when developing software applications.
d. Develop, test and maintain software programs for a variety of different application environments, such as real-time, embedded system applications and artificial intelligence.
e. Develop an appropriate and effective user-interface for a given implementation platform.
f. Select and use an appropriate simulation environment and toolset to test configurations and interfaces prior to implementation, and to assist in identifying problems with existing applications.
g. Develop and maintain both hardware-generic and hardware-specific drivers and applications, by applying hardware abstraction layer interfacing.
h. Design, implement, and query databases.
i. Assess and recommend software, as appropriate.
j. Analyze and summarize the implications of deploying an application.
k. Prepare, present and maintain current, clear and accurate documentation.

List of Abbreviations

ACM: Association for Computing Machinery

CIPS: Canadian Information Processing Society

CTAB: Canadian Technology Accreditation Board

ECAD: Electronic computer-aided design

FIPPA: Freedom of Information and Protection of Privacy Act

ICT: Information and Communication Technologies

IEEE: Institute of Electrical and Electronics Engineers

IoT: Internet of Things

ISO: International Organization for Standardization

PCB: Process Control Block

RFID: Radio-frequency identification

TAC: Technology Accreditation Canada

TCP/IP: Transmission Control Protocol and the Internet Protocol

Essential employability skills

All graduates of the Computer Engineering Technology program of instruction must have reliably demonstrated the essential employability skills learning outcomes listed below, in addition to achieving the vocational learning outcomes and meeting the general education requirement.

Context

Essential Employability Skills (EES) are skills that, regardless of a student's program or discipline, are critical for success in the workplace, in day-to-day living and for lifelong learning.

The teaching and attainment of these EES for students in, and graduates from, Ontario's Colleges of Applied Arts and Technology are anchored in a set of three fundamental assumptions:

- these skills are important for every adult to function successfully in society today;
- our colleges are well equipped and well positioned to prepare graduates with these skills;
- these skills are equally valuable for all graduates, regardless of the level of their credential, whether they pursue a career path, or they pursue further education.

Skill categories

To capture these skills, the following six categories define the essential areas where graduates must demonstrate skills and knowledge:

- Communication
- Numeracy
- Critical Thinking & Problem Solving
- Information Management
- Interpersonal
- Personal

Application and implementation

In each of the six skill categories, there are a number of defining skills, or sub skills, identified to further articulate the requisite skills identified in the main skill categories. The following chart illustrates the relationship between the skill categories, the defining skills within the categories and learning outcomes to be achieved by graduates from all postsecondary programs of instruction that lead to an Ontario College credential.

EES may be embedded in General Education or vocational courses, or developed through discrete courses. However these skills are developed, all graduates with Ontario College credentials must be able to reliably demonstrate the essential skills required in each of the six categories.

Skill category	**Defining skills:** Skill areas to be demonstrated by graduates:	**Learning outcomes:** The levels of achievement required by graduates. The graduate has reliably demonstrated the ability to:
Communication	• Reading • Writing • Speaking • Listening • Presenting • Visual literacy	1. communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience. 2. respond to written, spoken or visual messages in a manner that ensures effective communication.
Numeracy	• Understanding and applying mathematical concepts and reasoning • Analyzing and using numerical data • Conceptualizing	1. execute mathematical operations accurately.
Critical Thinking & Problem Solving	• Analyzing • Synthesizing • Evaluating • Decision making • Creative and innovative thinking	1. apply a systematic approach to solve problems. 2. use a variety of thinking skills to anticipate and solve problems.

Information Management	• Gathering and managing information • Selecting and using appropriate tools and technology for a task or a project • Computer literacy • Internet skills	1. locate, select, organize and document information using appropriate technology and information systems. 2. analyze, evaluate and apply relevant information from a variety of sources.
Interpersonal	• Teamwork • Relationship management • Conflict resolution • Leadership • Networking	1. show respect for the diverse opinions, values, belief systems and contributions of others. 2. interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals.
Personal	• Managing self • Managing change and being flexible and adaptable • Engaging in reflective practices • Demonstrating personal responsibility	1. manage the use of time and other resources to complete projects. 2. take responsibility for one's own actions, decisions and their consequences.

General education requirement

All graduates of the Computer Engineering Technology program must have met the general education requirement described below, in addition to achieving the vocational and essential employability skills learning outcomes.

Requirement

The General Education Requirement for programs of instruction is stipulated in the Credentials Framework (Appendix A in the Minister's Binding Policy Directive Framework for Programs of Instruction).

In programs of instruction leading to either an Ontario College Diploma or an Ontario College Advanced Diploma, it is required that graduates have been engaged in learning that exposes them to at least one discipline outside their main field of study and increases their awareness of the society and culture in which they live and work. This will typically be accomplished by students taking 3 to 5 courses (or the equivalent) designed discretely and separately from vocational learning opportunities.

This general education learning would normally be delivered using a combination of required and elective processes.

Purpose

The purpose of General Education in the Ontario college system is to contribute to the development of citizens who are conscious of the diversity, complexity and richness of the human experience; who are able to establish meaning through this consciousness; and who, as a result, are able to contribute thoughtfully, creatively and positively to the society in which they live and work.

General Education strengthens students' essential employability skills, such as critical analysis, problem solving and communication, in the context of an exploration of topics with broad-based personal and/or societal importance.

Themes

The themes listed below will be used to provide direction to Ontario Colleges in the development and identification of courses that are designed to fulfil the General Education Requirement for programs of instructions.

Each theme provides a statement of Rationale and offers suggestions related to more specific topic areas that could be explored within each area. These suggestions are neither prescriptive nor exhaustive. They are included to provide guidance regarding the nature and scope of content that would be judged as meeting the intent and overall

goals of General Education.

Arts in society:

Rationale:

The capacity of a person to recognize and evaluate artistic and creative achievements is useful in many aspects of his/her life. Since artistic expression is a fundamentally human activity, which both reflects and anticipates developments in the larger culture, its study will enhance the student's cultural and self-awareness.

Content:

Courses in this area should provide students with an understanding of the importance of visual and creative arts in human affairs, of the artist's and writer's perceptions of the world and the means by which those perceptions are translated into the language of literature and artistic expression. They will also provide an appreciation of the aesthetic values used in examining works of art and possibly, a direct experience in expressing perceptions in an artistic medium.

Civic Life:

Rationale:

In order for individuals to live responsibly and to reach their potential as individuals and as citizens of society, they need to understand the patterns of human relationships that underlie the orderly interactions of a society's various structural units. Informed people will have knowledge of the meaning of civic life in relation to diverse communities at the local, national and global level and an awareness of international issues and the effects of these on Canada, as well as Canada's place in the international community.

Content:

Courses in this area should provide students with an understanding of the meaning of freedoms, rights and participation in community and public life, in addition to a working knowledge of the structure and function of various levels of government (municipal, provincial, national) in a Canadian and/or in an international context. They may also provide an historical understanding of major political issues affecting relations between the various levels of government in Canada and their constituents.

Social and cultural understanding:

Rationale:

Knowledge of the patterns and precedents of the past provide the means for a person to gain an awareness of his or her place in contemporary culture and society. In

addition to this awareness, students will acquire a sense of the main currents of their culture and that of other cultures over an extended period of time in order to link personal history to the broader study of culture.

Content:

Courses in this area are those that deal broadly with major social and cultural themes. These courses may also stress the nature and validity of historical evidence and the variety of historical interpretation of events. Courses will provide the students with a view and understanding of the impact of cultural, social, ethnic or linguistic characteristics.

Personal Understanding:

Rationale:

Educated people are equipped for life-long understanding and development of themselves as integrated physiological and psychological entities. They are aware of the ideal need to be fully functioning persons: mentally, physically, emotionally, socially, spiritually and vocationally.

Content:

Courses in this area will focus on understanding the individual: his or her evolution; situation; relationship with others; place in the environment and universe; achievements and problems; and his or her meaning and purpose. They will also allow students the opportunity to study institutionalized human social behaviour in a systematic way. Courses fulfilling this requirement may be oriented to the study of the individual within a variety of contexts.

Science and technology:

Rationale:

Matter and energy are universal concepts in science, forming a basis for understanding the interactions that occur in living and non-living systems in our universe. Study in this area provides an understanding of the behaviour of matter that provides a foundation for further scientific study and the creation of broader understanding about natural phenomena.

Similarly, the various applications and developments in the area of technology have an increasing impact on all aspects of human endeavour and have numerous social, economic and philosophical implications. For example, the operation of computers to process data at high speed has invoked an interaction between machines and the

human mind that is unique in human history. This and other technological developments have a powerful impact on how we deal with many of the complex questions in our society.

Content:

Courses in this area should stress scientific inquiry and deal with basic or fundamental questions of science rather than applied ones. They may be formulated from traditional basic courses in such areas of study as biology, chemistry, physics, astronomy, geology or agriculture. As well, courses related to understanding the role and functions of computers (e.g., data management and information processing) and assorted computer-related technologies should be offered in a non-applied manner to provide students with an opportunity to explore the impact of these concepts and practices on their lives.

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