Computer Programming and Analysis

Section B.152
2025-08-19

Ontario College Advanced Diploma (3 Years - 6 Semesters) (2096)

705.759.6700 : 1.800.461.2260 : www.saultcollege.ca : Sault Ste. Marie, ON, Canada

PROGRAM OVERVIEW

Sault College is temporarily suspending a new intake of this program for the 2025 / 2026 Academic Year. The program is still running for all in-progress students. This program may be reinstated in a future Academic Year.

Like technology, we know your potential is limitless. Take your passion for technology one step further with our Computer Programming and Analysis advanced diploma program and pave the way to the career you dream of. Complete your two-year Computer Programming diploma and then seamlessly transition online for an additional year to earn your advanced diploma. In just three years, you will have two diplomas to prepare you for a rewarding career in software development and systems analysis.

Offered in partnership with Algonquin College, you'll master sound coding and software testing principles. Through proven methodologies and industry standards, develop the skills and knowledge to develop robust system solutions and meet the needs of the business world.

Explore cutting-edge industry software and technology, including object-oriented methodologies, database design, cybersecurity, and quality assurance. From systems analysis and design to development operations, immerse yourself in the latest innovations of information technology.

Gain real-world experience by completing a project over two semesters where you will develop a prototype software system by analyzing and improving a process or system for a business, individual, or community. Connect with local businesses to identify areas needing improvement, and then design and develop your software prototype to address identified issues to support the business.

As businesses evolve, the demand for skilled programmers and software developers continues to soar. Seize the opportunity and continue your path to a valuable career.

Please Note: Semesters 1 to 4 are taken in the 2-year Computer Programmer program. Upon successful completion of the Computer Programming program, students will have the option to enter semester 5 of the Computer Programming and Analysis program. (subject to enrolment)

PROGRAM OUTCOMES

A graduate of Computer Programming and Analysis at Sault College will reliably demonstrate 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

relationships.
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. gather, analyze and define software system specifications based on functional and non-functional requirements.
11. design, develop, document, implement, maintain and test software systems by using industry standard software development methodologies based on defined specifications and existing technologies/frameworks.
12. select and apply object-oriented and other design concepts and principles, as well as business requirements, to the software development process.
13. gather requirements and model, design, implement, optimize, and maintain data storage solutions.
14. integrate network communications into software solutions by adhering to protocol standards.

Reference

Ministry of Training, Colleges and Universities Computer Programming and Analysis Program Standards (MTCU 60503), November 2018.

ADMISSIONS

MINIMUM ACADEMIC REQUIREMENTS

Completion of the 2-year Computer Programming program. Missing any requirements? Get them for free from Academic Upgrading.

CAREER PATHS

A strong demand for programming/analysis graduates exists in a number of different businesses and industries both locally and nationally. Graduates may seek employment in a wide range of positions such as: software development, systems analysis and design, user interface design and human factors, web and database design and programming, project management, system and database administration, end user support, management of technology. Potential for career advancement and portability of skills is high.

OTHER INFORMATION

Program College Contact: Rodney Martin, rodney.martin@saultcollege.ca

PROGRAM OF STUDY

SEMESTER 1
CMM115-3 Communications I

CSD110-4 Introduction to Programming
CSD113-4 Computing Environments and Tools
CSD122-5 Hardware, OS, and Networks
MTH123-3 Computer Mathematics
GIS100-3 Exploring GIS

SEMESTER 2
CSA103-4 Business Applications I
CSD112-4 Introduction to Web Development
CSD121-4 Programming Concepts I
CSD123-4 Databases I
CSD125-3 Emerging Technology
CSD126-4 Cloud Computing

SEMESTER 3
CSD124-3 Systems Analysis and Design
CSD214-4 Programming Concepts II
CSD216-4 Databases II
CSD217-4 Web Development II
CSD318-4 Project Management
GEN100-3 Global Citizenship

SEMESTER 4
CMM215-3 Business Communication
CSD227-4 Computer Security, Privacy, and Ethics
CSD228-4 Mobile Applications
CSD230-5 Advanced Web Applications
CSD235-4 Capstone Project

Select one of the following:
GEN110: Student Selected General Education

SEMESTER 5
CST8400-4 Analysis and Design using Emerging Technologies
CST8410-4 Advanced Mobile Applications
CST8411-3 Information Systems Development and Deployment
CST8412-4 User Interface Design in Application Development
CST8413-4 Data Warehousing and Advanced Business Intelligence
CST8414-3 Applied Research Project 1

SEMESTER 6
CST8512-4 Cybersecurity
CST8513-4 Quality Assurance and Testing
CST8514-4 Business and Information Technology
CST8515-5 Applied Research Project 2
MGT0014-3 Entrepreneurship

Course Descriptions

Semester 1

Communications I (CMM115) (3 credits)

This course is designed to help students develop the skills necessary to communicate effectively in their programs and at the college level. Students will think critically to capture the meaning messages and

respond appropriately; produce coherent, clear paragraphs; and purposively research and responsibly integrate credible sources into their own writing. Emphasis is placed on the writing process, from planning to revising, while providing opportunities to explore various modes of communication.

Introduction to Programming (CSD110) (4 credits)

The ability to solve arbitrary problems using a computer programming language is a valuable skill for anyone. Accessible to all regardless of previous experience, the goal of this course is to give students a sense of how to solve computing problems using the fundamental constructs in all programming languages: values, types, operators, variables, lists, conditionals, loops, functions, input & output. Students gain an understanding of how to break problems into sub problems that can be solved using these fundamental constructs, and they learn how computers can `understand` and execute the instructions they write in their programs.

Due to their low barrier to entry and wide adoption, Python and/or JavaScript will be used as the programming language of delivery.

Computing Environments and Tools (CSD113) (4 credits)

Students will acquire the skills necessary to operate and manage industry-standard Windows and Unix-style operating systems. Topics may include file permissions, network file transfer, web and DNS server configuration, virtual machines, container systems, and others depending on program needs and student interest. Students will gain hands-on experience using command line and secure shells like Bash and PowerShell, and will learn how to use version control systems like Git to track changes in software code files.

Hardware, OS, and Networks (CSD122) (5 credits)

Students receive an overview of computer hardware, software, and networking to expose them to the foundational technologies on which all computer software operates. The hardware components of a typical computer system are studied as well as system level software such as operating systems and device drivers. An introduction to assembly language programming gives students the ability to write assembly language programs, then compile and execute for performance reasons or to interact directly with hardware in ways unsupported by the higher-level languages. The essentials of networking are studied using working hardware to experiment with networking communication, resource sharing, and encryption.

Computer Mathematics (MTH123) (3 credits)

Learners in this course explore mathematical concepts that strengthen understanding of the computer programming skills acquired in this program. Number systems, linear algebra, discrete mathematics, graphs, and statistics are investigated with regard to their application in computer programming, data analysis, and machine learning. Emphasis is placed on developing logical thinking skills and an algorithmic approach to problem-solving.

Exploring GIS (GIS100) (3 credits)

This course introduces Geographic Information Systems (GIS) technology and its applications in various fields such as urban planning, environmental science, natural resource management, public health, and criminology. Using GIS software, students will explore real-world scenarios through spatial analysis by identifying patterns and trends that can lead to solutions and impact future decision making opportunities.

Semester 2

Business Applications I (CSA103) (4 credits)

Information technology professionals must be comfortable using tools that support their workplace operations. In this course, learners work with communication and presentation solutions to effectively deliver and communicate in the workplace. Business skills are acquired using spreadsheets, databases, and organizational secure storage platforms. Using Power BI, learners will produce data analytics outputs from hands-on applications using geographic information systems and databases.

Applications used in this course may include Outlook, Excel, PowerPoint, SharePoint, MS-Project, Power BI, MS SQL Server, and ArcGIS.

Introduction to Web Development (CSD112) (4 credits)

HTML and CSS are the fundamental technologies for creating web interfaces. After a brief introduction to the World Wide Web, students learn the HTML elements that are used in all web pages, including page layout elements, tables, forms, and more modern media elements for video and audio. Students also learn advanced styling techniques using CSS to give web sites custom layouts and appearances, including responsive design and CSS animation. Throughout the course, accessibility standards to make web sites usable to the widest possible audience are highlighted.

Students use modern web browsers, GitHub, and Visual Studio Code to create working web sites.

Programming Concepts I (CSD121) (4 credits)

Organizing and testing code is important in managing software complexity. Students in this course are introduced to Object Oriented Programming (OOP) as a way to structure software in a maintainable and testable way. Topics include interfaces, polymorphism, inheritance, type systems, and important data structures. Students build working applications and learn to validate their programs using appropriate tests.

This course is delivered using the Java programming language.

Databases I (CSD123) (4 credits)

Databases are employed for data storage and retrieval in most software systems. Learners in this course are introduced to relational and non-relational (NoSQL) databases and their typical uses. By interacting with real databases, students gain an understanding of the importance of normalization and the advantages and disadvantages of the relational and non-relational models. Students use SQL to manipulate and query relational databases and gain hands-on experience with the use of non-relational databases.

As part of this course, students use popular database systems, which may include MySQL, SQLite, MongoDB, etc.

Emerging Technology (CSD125) (3 credits)

It is important for professionals to remain cognizant of the trajectory of changes in the rapidly evolving

field of information technology. Through research and prototyping, students in this class explore topics of interest currently emerging in tech. A final presentation gives students opportunity to practice communication skills and share findings with their colleagues.

Cloud Computing (CSD126) (4 credits)

Much software development and infrastructure is managed in the cloud. This course focuses on the development and deployment of software in cloud environments. Learners will gain a comprehensive understanding of cloud computing principles, architectures, and services. The course covers key concepts such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS), and associated tools and services. Emphasis will be placed on practical skills for using leading cloud platforms like Microsoft Azure, Amazon Web Services (AWS), and Google Cloud Platform (GCP).

Semester 3

Systems Analysis and Design (CSD124) (3 credits)

This course provides learners with a structured, methodical approach to designing software systems, hardware networks and web-based cloud solutions. Analysis of existing industry projects will be conducted, identifying their successes and failures. As part of their project work, the learner will incorporate industry best practices while avoiding pitfalls. A number of diagramming methods and types will be used in the design and planning stages, including but not limited to uml object and class modeling, entity relationship modeling, sequence diagrams, business and process flow diagrams.

Programming Concepts II (CSD214) (4 credits)

All programmers must learn to manage complexity in their software. By exploring advanced data structures, design patterns, software design principles, software testing, Model-View-Controller (MVC) frameworks, and Object-Relational Mappers (ORMs), learners in this course practice the high-level design and development techniques that make software systems simpler to test, enhance, and maintain.

This course is delivered using the Java programming language.

Databases II (CSD216) (4 credits)

The design of a database largely determines its efficiency and integrity. Learners in this course analyze and model information systems using Entity-Relationship diagrams and normalization techniques for relational databases, as well as the contrasting design needs of business intelligence and non-relational databases. Database administration techniques are explored in practical exercises using industry standard software tools.

Web Development II (CSD217) (4 credits)

Dynamic web applications are ubiquitous in today's online landscape, and this course provides students with a foundation in the technologies involved in creating them. JavaScript and TypeScript are used to create both server- and client-side applications, with a focus on the fundamental protocols, APIs, processes, and security concerns that underpin most web applications. Activities and projects give students practical experience in developing both the server- and client-side portions of web applications using industry standard tools.

Project Management (CSD318) (4 credits)

This course provides a comprehensive overview of Project Management from an Information Technology perspective. Students will study and apply techniques from the various Project Management knowledge areas including project integration, scope, time, cost, quality, human resources, communications, risk and procurement management. Students will acquire practical skills in assignments and in a team-based project that will lead to a culminating Capstone Project in their final term.

Global Citizenship (GEN100) (3 credits)
The world we are living in is one in which local, national and international issues are interwoven, and the need for us to understand the impact these issues can have on our lives has never been greater! Using a socio-cultural, political and environmental lens, students will view how the world is changing and how to become active agents of change from the local to international level. Important issues such as social injustice, poverty, environmental protection, resource scarcity, sustainability, and health will be addressed. Global citizenship is an opportunity to `Be the Change`. This course meets the Civic Life and Social and Cultural Understanding General Education themes.

Semester 4

Business Communication (CMM215) (3 credits)
This course provides employment-related theory and practice in those written and oral reporting skills typical of a modern business or institution. The principles of writing are taught through the writing process.

Computer Security, Privacy, and Ethics (CSD227) (4 credits)

This course focuses on high-level computer, network and cloud security and privacy concepts. The learner will apply hands-on skills in establishing then implementing security policies to protect systems and data from internal and external threats. The topics of cyber-security, ransomware, social engineering and phishing will be explored in detail. Cryptography, encryption and hashing methods along with firewall defence, will be applied in various scenarios, then tested for resiliency. Packet Analysis tools will be used by the learner to extract data flowing through systems and across networks.

Mobile Applications (CSD228) (4 credits)

Mobile devices are the most widely used computing devices today. Students in this course are introduced to mobile application development concepts and tools. Topics include current industry development environments, user interfaces, mobile programming, data storage, debugging and deployment. Students apply concepts and write applications for mobile devices using a mobile app development environment.

Advanced Web Applications (CSD230) (5 credits)

The tools and design patterns used to build modern web applications are constantly evolving. Learners in this course explore and employ a variety of widely used libraries, frameworks, and technologies to prepare them for modern web application development. Topics include full-stack application design and development, testing, deployment, reactive frameworks, and web security.

JavaScript, TypeScript, Node.js, Java, and PHP may all be used at times throughout the course. Learners will work with popular technologies such as React, Next, Spring, or similar.

Capstone Project (CSD235) (4 credits)

A portfolio of significant experience in software development is a valuable asset for individuals seeking their first programming job. In this course, students will culminate the skills and knowledge they have obtained in this program by proposing and prototyping a substantial software project. Students may collaborate with local organizations, the college`s Applied Research Centre, or embark on a software business venture. Students will work in teams using business practices to produce deliverables and meet criteria that will be required throughout the term. Mentoring in project management and technical implementation will be provided to help teams achieve their goals. In addition to the project, students will be individually graded on reflections and assessment of their contributions.

Student Selected General Education (GEN110) (3 credits)

For Transfer Credit Purposes only.

Semester 5

Analysis and Design using Emerging Technologies (CST8400) (4 credits)

In the world of technology there is an ever changing and growing number of disruptive products, exciting tools and assistive services technology professionals can leverage to invent, develop and produce technology solutions. Students explore emerging technologies and further develop skillsets to rapidly build and deploy technology solutions. Students research emerging technologies and through hands-on learning, examine and implement these cutting-edge solutions. Topics may include machine learning and artificial intelligence, the Internet of Things (IoT), blockchain, big data, data analytics and visualization.

Advanced Mobile Applications (CST8410) (4 credits)

Mobile devices are the primary means of communication in today’s world, and having knowledge in development of mobile applications is advantageous. Students expand their mobile application development knowledge through applied projects. Topics include an in-depth study of application development, integration of application programming interfaces (APIs) and utilization of mobile cloud services. Students experiment with location, networking, data storage, wearable technology and wireless communication using current industry protocols. The final capstone project is based on individual or group application development.

Information Systems Development and Deployment (CST8411) (3 credits)

In a team environment, it is important to coordinate development efforts to increase efficiency and reduce errors. Students explore the techniques and architectures involved in developing, testing and deploying full-stack applications. The various phases of continuous integration and delivery are a key focus as well as application architecture and API design. Through a hands-on approach, students have an opportunity to work in teams to enhance, test and deploy a working full-stack application.

User Interface Design in Application Development (CST8412) (4 credits)

Possessing the skills to write software that is user-friendly, accessible and maintainable is desirable by industry and end users. Students gain hands-on experience in developing and deploying database-driven applications, with a focus on high-level software architecture and building interactive graphical user interfaces. Through extensive lab work, students build on their previous knowledge of software design to implement modular, testable application code. Students examine and utilize modern approaches to interface design using native and custom interface controls. Techniques for interacting with operating system APIs are explored.

Data Warehousing and Advanced Business Intelligence (CST8413) (4 credits)

Data warehousing systems are a foundation for Business Intelligence (BI) and decision making within an organization. Through designing and maintaining data warehouses, students examine the unique design requirements of data warehouses and gain experience performing Extraction, Transformation and Loading (ETL) processes. Students explore the analysis and presentation tools and techniques that can help inform and improve data-driven decisions.

Applied Research Project 1 (CST8414) (3 credits)

Experience with practical projects provides students with learning opportunities to gain industry-relevant insight and experience. Through collaborative participation in applied research projects and working closely with stakeholders in real-world workplace environments, students develop solutions for problems of significant technical complexity. The phases of software development are expanded on including gathering requirements, documenting, designing, coding and testing working software prototypes. Knowledge about testing, debugging and quality assurance is expanded along with Agile software development methodology practices including Scrum, Kanban and Lean. Drawing upon skills previously acquired, students plan, conduct research for, and begin the creation of a written report that summarizes the work and findings resulting from the first release of the project.

Semester 6

Cybersecurity (CST8512) (4 credits)

Organizations recognize the importance of cybersecurity in the design, development and management of information systems. Students explore cybersecurity threats and best-practice responses to those threats. Primary focus is given to software and application layers. As well, to give students a broad understanding of the threat landscape, a variety of attack vectors through to the network and physical layers are discussed. Students gain hands-on experience with the tools and techniques used to mitigate security threats, and consider policies and regulations regarding cybersecurity and information privacy.

Quality Assurance and Testing (CST8513) (4 credits)

Assuring the quality of information technology systems is vital as these systems support businesses, health systems, entertainment franchises and more. Students employ a variety of testing strategies and industry best practices to analyze, document, develop, monitor, and maintain robust computing system solutions. Students develop these skills through a combination of lecture and practical activities using industry tools and techniques.

Business and Information Technology (CST8514) (4 credits)

Information systems are an integral part of conducting business in today`s world. An understanding of business concepts is key to the analysis and design of business information technology systems. Students develop an awareness of business concepts, business information systems, business processes, risk assessment, business impact analysis, software licensing, ethics, government standards, regulatory compliance and business media in the context of systems analysis and design and personal and professional development. Theory is reinforced with discussions, group work, case study and research.

Applied Research Project 2 (CST8515) (5 credits)

The ability to identify and satisfy all stakeholder expectations is essential in successful product development and delivery. Students collaborate to complete their applied research project in consultation

with faculty and community partner to create deliverables by monitoring and controlling the project resources. Activities include implementing, testing, debugging and deploying information technology systems, creating installation packages, addressing security issues and concerns, adhering to quality assurance standards, and creating supporting documentation. Students defend developed solutions in formal oral and written presentations and showcase the project to peers, faculty, staff and invited guests.

Entrepreneurship (MGT0014) (3 credits)

Taking a concept for a software product or service to market requires specific business knowledge. Students examine entrepreneurship as a fundamental skill for Information Technology (IT). Students explore how to investigate and develop the key components of a successful business plan. Focus is on developing business skills and innovative attitudes essential for those who want to be a founder of a technology start-up, a product manager working in a technology start-up, or an agent of change in an existing company.