

# Undergraduate Computer Science



The last 25 years have seen dramatic growth in the demand for professionals trained in computer information and communication technologies. This growth was partly driven by tremendous technological advances, such as the emergence of computer networking, database management, graphical user interfaces, data analytics, artificial intelligence (AI), and their applications. But the growth in demand was also driven by a much greater realization on the part of many organizations and individuals of the importance of advanced computer technologies for their well-being and the more widespread use of these technologies (Denning, 2001a; 2001b).

## At Ottawa University

The Computer Science major provides a path for students from diverse backgrounds to rapidly transition to computing and information system career paths by providing them with foundation and advanced undergraduate level courses in computing and information science. The program focuses on the science of computers, computing problems and programming solutions, and the design of computer systems and user interfaces from a technology perspective. The program includes instruction in computational science principles, computing theory; computer hardware design; computer technology development and programming; and applications to graphic user interface situations. Graduates of the program will gain the foundation, proficiency, and confidence in processes that handle and manipulate large amounts of information with applications in business, education, game theory, modeling, health, information security, life sciences, manufacturing, and other related careers.

## Careers

The future business environment will be characterized by rapid technological changes, intense global competition, faster product life cycles, and more complex, specialized markets. As such, the computing and information needs of organizations are increasingly complex and rapidly changing. Individuals with computing and information systems expertise can design and develop computer and information technology products, design and build information systems, manage sophisticated information resources, work on interdisciplinary teams, and communicate effectively within the organization and other end-users.

## Education and Qualifications

This degree prepares students to enter the workforce as a computer programming professional. The concentrations available: Artificial Intelligence, Cybersecurity, Game Design, and Information Technology Systems; provide additional opportunities for specialization and thus additional career pathways in the computer science and technology industry.



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## Foundation Courses

### **MAT 21044** Calculus I

First in a series of three courses that offers an intuitive approach to the major concepts and techniques of single-variable calculus. Topics include limits, continuity, derivatives of elementary functions and their application, extrema, optimization, elementary integration applications, the Fundamental Theorem of Calculus, and l'Hospital's rule. Prerequisite: Score of 16 on math-track initial placement OR a "C" or better in MAT 11143 Precalculus.

### **MAT 21144** Calculus II

Second course in a series of three courses that offers an intuitive approach to the major concepts and techniques of single-variable calculus. Topics covered include techniques of integration, integration applications, first-order linear and first-order separable differential equations, sequences, series, convergence tests, power series, and the calculus of parametric and polar equations. Prerequisite: A "C" or better in MAT 21044 Calculus I (or equivalent).

### **CST 20363** Introduction to Computer Science

This course is a survey of Computer Science's discipline and its interaction with other disciplines, incorporating historical development, theories, and computer science tools (algorithm design and programming). Topics include mechanical computers, digital computers, bioinformatics, microcontrollers, robotics, security, scientific computing, simulation, and web technologies.

### **ITS 20263** Introduction to Networking

Basic knowledge of how to collect, organize, and analyze data. An introduction to the concepts of querying, updating, and administration of databases. Topics covered include normalization, table structures, table relationships, and data integrity.

### **ITS 20163** Introduction to Database

Identify basic networking concepts, distinguish between network transmission types and connectivity devices, understand TCP/IP components, demonstrate knowledge of network hardware, cabling, and operating systems.

### **CST 16163** Introduction to Computer Programming

This course introduces the fundamentals of computer programming, which is the foundation of Computer Science. Students design, write and debug code by using Python programming language.

## Required Major Courses

### **CST 30004** Cloud Computing Architecture

This course is an introduction to the core concepts of Cloud Computing. The students will gain the foundational knowledge required to understand cloud computing from a technical, business perspective and become a Cloud practitioner. The most critical APIs used in the Amazon and Microsoft Cloud environments, including the techniques for building, deploying, and maintaining machine images and applications, will be examined. The students will learn about the various Cloud Service models (IaaS, PaaS, SaaS) and deployment models (Public, Private, Hybrid) and the critical components of Cloud infrastructure (VMs, Networking, Storage - File, Block, Object, CDN). Prerequisite: ITS 20263 Introduction to Networking.

### **CST 30003** Microprocessors

An introduction to the architecture, operation, and application of microprocessors. Topics include assembly language programming, addressing, system clock and timing, serial and parallel ports, input/output devices, and interrupts. Cross-listed with EGR 30003 Microprocessors. Prerequisites for EGR: EGR 10000 Intro to Engineering, EGR 20003 Circuits, and MAT 20043 Discrete Math. Prerequisites for CST: CST 20363 Introduction to Computer Science

### **CST 48163** System Analysis and Design

This course is an in-depth study of the systems development life cycle. The purpose of the course is to utilize a blend of traditional development and current techniques. Systems Analyst planning includes the methodology, economic analysis, and project management. Cross-listed with MIS 48163 Systems Analysis and Design.

### **CST 35566** Intermediate Programming Techniques

This course provides the transition from Introduction to Computer Programming to the object-oriented paradigm. Proper formulation and abstraction of the problem domain in the programming process to build robust, flexible and extensible programs are emphasized. The student learns how design patterns help formulate and implement abstractions in an effective and sophisticated manner. The course covers data structures and algorithms to manipulate them from essential to programming, such as lists, stacks, queues, trees, and tables. Prerequisite: ITS/CST 16163 Introduction to Computer Programming. Cross-listed with ITS 35566 Intermediate Programming Techniques.

### **CST 35500** Special Topics Information Technology Systems

Designed around particular theories, practices, or interests of an individual or group of students. Cross-listed with ITS 35500 Special Topics Information Technology Systems.

### **CST 45566** Advanced Programming Techniques

This course aims to study the required concepts and techniques to write high-quality code using the object-oriented programming environment approach. The course covers GUI development, coding, decision-making, control structures, and modular design. Advanced topics include class creation and usage, exception handling, accessing databases, and creating web and console applications. Prerequisite: ITS 35566 Intermediate Programming Techniques. Cross-listed with ITS 45566 Advanced Programming Techniques.

### **CST 49090** Senior Research CAPSTONE Design

This course prepares students for the individual Senior Capstone Project. Students will work in a multidisciplinary environment on approved design projects, the practice design methodology, conducting a complete project feasibility study and preliminary design, including optimization, product reliability, and the application of informatics. A final report and presentation are required.

### **CST 49100** Senior CAPSTONE Project

In this Senior Completion Project Course, students will execute their Senior Research Capstone Design project. This course is the opportunity to integrate students' knowledge that they have gained across the Computer Science curriculum. Students choosing applied projects engage in the identification of a problem, develop a project proposal outlining an approach to the problem's solution, implement the proposed solution, and test or evaluate the result. Students choosing a theory project conduct original research and assess its strengths and limitations. Students document their work in the form of written reports and oral presentations. Prerequisite: CST 49090 Senior Research CAPSTONE Design This course is required to graduate.

## Available Concentrations

- Cyber Security
- Game Design & Development
- Information Technology Systems