List of courses and their descriptions for the Master of Computer Science (MCS)

Students must take 8 core courses and 2 elective courses to complete the MCS.
8 core (required) courses:

COSC5806 Data Analysis with Python
This course provides advanced techniques and algorithms in the Python programming language needed for acquiring, cleaning, transforming, modelling and visualizing data to discover useful information for supporting decision-making. Advanced data analysis computing topics to be solved by programming are covered. The course also includes installing and exploring scientific computation tools, modules, libraries and APIs widely used in many data analysis techniques. 3 credits; lectures and seminars. Required course.

COSC5856 Introduction to Cybersecurity
An introduction to cybersecurity covering a wide range of vulnerabilities, attacks, and defence mechanisms in individual computers, networks, the Internet and the Web and applications that use them, and storage and computational clouds. The human side of cybersecurity,

COSC5506 Advanced Software Engineering
Designing and constructing large software systems: requirements analysis, architectural design, detailed design and specification, implementation, test planning, delivery, and evolution. Project and configuration management issues. This course includes a team project. 3 credits; lectures and seminars. Required course.

COSC5206 Graduate Seminar
This seminar includes computer science areas that are presented by the course instructor, and by students who are asked to study and discuss academic papers during the course. The course will generally include topics not taught in the other courses from this graduate program and will focus on effective and efficient independent research approaches in computer science and information technology, including literature searches, presentation and discussion of research material, and the ability to identify possible new areas for investigation and development. 3 credits; seminars. Required course.

COSC5906 Advanced Topics of Computer Networks
This is an advanced course on computer networks, the mechanisms used in their construction, and the factors that affect their performance. Fundamental concepts in the design and implementation of computer communication networks, protocols, and applications will be covered in this course This course covers the seven-layered ISO Open Systems Interconnection model for computer networks. Both hardware and software topics are considered. Typical applications including mail networks, electronic offices, and distributed file systems are studied in this course. Standard transport technologies based on point-to-point links and on broadcast principles are covered in this course. 3 credits; lectures and seminars. Required course.

COSC5437
Neural Networks and Deep Learning
This course intends to introduce the fundamentals of neural networks and deep learning with Keras and TensorFlow. Students will learn to build, train, and deploy fully connected deep neural networks, including convolutional neural networks (CNN), recurrent neural networks (RNN), and reinforcement learning. Applications of deep learning to computer vision, processing sequences, natural language processing, and others. Students will also learn representation learning and generative learning using autoencoders and GANs. 3 credits; lectures and seminars. Required course.

COSC5756 Cloud Computing

Students who take this course seek to master the concepts and fundamentals underlying cloud computing, cloud services, and cloud applications. In this course, students analyze and investigate services and technologies of the cloud services industry, applying top cloud platforms, and designing and deploying highly scalable, fault-tolerant cloud applications. Developing skills include computer server configuration and cloud infrastructure. 3 credits; lectures and seminars. Required course.

COSC5926
Advanced Topics in Human-Computer Interaction

A survey of strategies and practices in Human-Computer Interaction (HCI) design and evaluation, as well as analysis and application of new paradigms in HCI. Students will learn to perform studies in user interface design and user experience (UX) analysis, read the research literature critically, distill important points from readings, summarize, and write papers as well as design novel user interfaces by conducting projects and presenting their written and oral work. 3 credits; lectures and seminars. Required course.

List of elective courses (students are required to take two of them):

COSC5406 Machine Learning

This course intends to introduce machine learning basics and a set of tools used in
machine learning. Students will learn different supervised and unsupervised learning algorithms
including linear regression, gradient descent, polynomial regression, regularization, logistic regression, Naïve Bayes, k-nearest neighbours, support vector machines (SVMs), decision trees, ensemble learning and random forests, k-means clustering, Gaussian mixture model (GMM), Principal Component Analysis (PCA), tSNE, feature extraction and selection. Topics include applications in image processing, natural language processing, computer vision, bioinformatics, and genomics.

COSC5086 Computing Project

In this course, each student conducts practical development with limited research on an approved comprehensive software and/or hardware computing project, with its respective related research, and with enough breadth and depth. Students are asked to write a comprehensive report, followed by a public presentation of the research/development project. The content of this project should be separate from other projects the student has completed in other courses. Group projects are allowed with prior departmental consent. School approval is required before registration and students need to present a proposal at least 20 days before approval. Each student or group's project will be supervised by a faculty member. PREREQUISITE: Successful completion of the core courses. Seminars. Elective course.

COSC5706 Robotics

This course will introduce students to the modelling, design, planning, and control of robot systems. Particularly, it will cover the mathematics used to describe positions and orientations in 3D space, the geometry of robotics manipulators, kinematics, dynamics, trajectory planning, controlling robotic manipulators, and programming robots. This course will emphasize the computational aspects of the problems. 3 credits. Elective course.

COSC5606 Database Management Systems (joint-enrolled with COSC4606 Data Management Systems)

The course provides an introduction to the design and use of database management systems, particularly the relational database model. Topics covered include data modelling, relational query languages, query optimization, and logical and physical database design with the entity-relationship data model. Advanced topics include data warehousing design and implementation, big data developments and an introduction to advanced analytics. Project work will provide students with hands-on experience with the entire database development cycle. Elective course.

COSC5556 Software Design and Implementation

General characteristics of designs and design methods. Survey of design methods: information hiding; object-oriented design; state machine methods; data flow design. Module specification techniques: first-order logic; algebraic specification; trace specification; weakest preconditions; the refinement calculus; and abstract modelling. Transition from design to implementation. 3 credits; lectures and seminars. Elective course.

COSC5596 Mobile Programming

Students will learn how to program high-quality real-world mobile, Web and native applications and solutions using a variety of technologies and programming languages for a variety of leading mobile devices. Students will study the design of user interfaces and software systems using the most common languages and frameworks and relate to associated topics such as mobile gaming, hosting infrastructure, and security. 3 credits; lectures and seminars. Elective course.

COSC5996 Wireless and Mobile Networking

This course introduces the different paradigms of wireless and mobile networking. It will also familiarize students with state-of-the-art technologies, as well as with recent efforts in research and standardization. Students taking this course will develop a strong grasp of the different architectures involved in current and future wireless networks, have a functional understanding of the different paradigms, and design and analyze the behaviour of wireless and mobile network protocols using one or more network simulation tools. 3 credits; lectures and seminars. Elective course.

COSC5196 Advanced Cryptography and Cryptanalysis

This course provides an in-depth understanding of modern cryptography, with an emphasis on practical applications. Topics covered include classical systems, information theory, symmetrical cryptosystems, block ciphers, stream ciphers, DES, AES, asymmetric cryptosystems, ECC, provable security, key exchange and management, and authentication and digital signatures, among others. 3 credits. Lectures and seminars. Elective course.

COSC5356 Advanced Systems Programming

This course covers advanced topics in software development techniques for systems programming using the C language in the UNIX environment. Topics include the overview of UNIX/Linux operating systems, shell programming, scripting languages, system calls, process control and communication, the use of fork and exec signals, file processing, filters, pipes, introduction to concurrency, network programming, multi-threading, internet client/server application and service development. 3 credits; lectures. Elective course.

COSC5426/COSC5427 Special Topics Course (joint-enrolled with COSC4426 Topics in Computer Science I or COSC4427 Topics in Computer Science II)
A course in Computer Science involving the treatment of a selection of advanced topics.
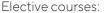3 credits; lectures. Elective course.

COSC5106
Design and Analysis of Advanced Computer Algorithms
This course intends to introduce advanced algorithms methodology for designing efficient algorithms. Topics include space and time complexity, asymptotic bounds on the performance of algorithms, advanced data structures, advanced design and analysis techniques, multithreaded algorithms, linear programming and reductions, NP-complete problems, Coping with NP-completeness, and approximation algorithms. 3 credits; lectures and seminars. Elective course.

Concise list:
Required courses for the MCS:
COSC5806 Data Analysis with Python
COSC5856 Introduction to Cybersecurity
COSC5506 Advanced Software Engineering
COSC5206 Graduate Seminar
COSC5906 Advanced Topics of Computer Networks
COSC5437 Neural Networks and Deep Learning
COSC5756 Cloud Computing
COSC5926 Advanced Topics in Human-Computer Interaction

Elective courses:

COSC5086 Computing Project
COSC5706 Robotics
COSC5606 Database Management Systems (joint-enrolled with COSC4606 Data Management Systems)
COSC5556 Software Design and Implementation
COSC5596 Mobile Programming
COSC5996 Wireless and Mobile Networking
COSC5196 Advanced Cryptography and Cryptanalysis
COSC5356 Advanced Systems Programming
COSC5426/COSC5427 Special Topics Course (joint-enrolled with COSC4426 Topics in Computer Science I or COSC4427 Topics in Computer Science II)
COSC5106 Design and Analysis of Advanced Computer Algorithms