Networking Technology

This section presents the requirements for programs in:

- **M.A.Sc. Networking Technology**
- **M.A.Sc. Networking Technology with Collaborative Specialization in Cybersecurity**
- **Master of Networking Technology**
- **Master of Networking Technology with Collaborative Specialization in Cybersecurity**

Program Requirements

M.A.Sc. Networking Technology (5.0 credits)

Requirements:

1. 0.0 credit in:		
ITEC 5001 [0.0]	Information Technology Seminars	
2. 1.5 credits from core courses (For students admitted to 4.0-credit program, 1.0 credit):		1.5
ITEC 5100 [0.5]	Planning and Design of Computer Networks	
ITEC 5101 [0.5]	Cross Layer Design for Wireless Multimedia Networks	
ITEC 5102 [0.5]	Designing Secure Networking and Computer Systems	
ITEC 5103 [0.5]	Cloud and Datacentre Networking	
ITEC 5205 [0.5]	Design and Development of Data-Intensive Applications	
ITEC 5910 [0.5]	Special Topics in Network Technologies	
3. 1.0 credit in electives at the 5000-level, chosen in consultation with your graduate advisor/supervisor or the Associate Director of Graduate Studies in the School.		1.0
4. 2.5 credits in:		2.5
ITEC 5909 [2.5]	Master's Thesis	
Total Credits		**5.0**

M.A.Sc. Networking Technology with Collaborative Specialization in Cybersecurity (5.0 credits)

Requirements:

1. 1.0 credit in:		1.0
CYBR 5000 [1.0]	Science and Social Science of Cybersecurity	
2. 0.0 credit in:		
ITEC 5001 [0.0]	Information Technology Seminars	
3. 1.0 credit from core courses:		1.0
ITEC 5100 [0.5]	Planning and Design of Computer Networks	
ITEC 5101 [0.5]	Cross Layer Design for Wireless Multimedia Networks	
ITEC 5102 [0.5]	Designing Secure Networking and Computer Systems	
ITEC 5103 [0.5]	Cloud and Datacentre Networking	
ITEC 5205 [0.5]	Design and Development of Data-Intensive Applications	
ITEC 5910 [0.5]	Special Topics in Network Technologies	
4. 0.5 credits in electives at the 5000-level, chosen in consultation with your graduate advisor/supervisor or the Associate Director Graduate Study in the School.		0.5
5. 2.5 credits in:		2.5
ITEC 5909 [2.5]	Master's Thesis (in the area of the specialization)	
Total Credits		**5.0**

Master of Networking Technology (5.0 credits)

Requirements:

1. 0.0 credit in:		
ITEC 5001 [0.0]	Information Technology Seminars	
2. 2.5 credits from core courses:		2.5
ITEC 5100 [0.5]	Planning and Design of Computer Networks	
ITEC 5101 [0.5]	Cross Layer Design for Wireless Multimedia Networks	
ITEC 5102 [0.5]	Designing Secure Networking and Computer Systems	
ITEC 5103 [0.5]	Cloud and Datacentre Networking	
ITEC 5205 [0.5]	Design and Development of Data-Intensive Applications	
ITEC 5910 [0.5]	Special Topics in Network Technologies	
3. 2.5 credits in electives at the 5000-level, chosen in consultation with your graduate advisor/supervisor or the Associate Director of Graduate Studies in the School.		2.5
Total Credits		**5.0**

Master of Networking Technology with Collaborative Specialization in Cybersecurity (5.0 credits)

Requirements:

1. 1.0 credit in:		1.0
CYBR 5000 [1.0]	Science and Social Science of Cybersecurity	
2. 0.0 credit in:		
ITEC 5001 [0.0]	Information Technology Seminars	
3. 2.0 credits from core courses:		2.0
ITEC 5100 [0.5]	Planning and Design of Computer Networks	
ITEC 5101 [0.5]	Cross Layer Design for Wireless Multimedia Networks	
ITEC 5102 [0.5]	Designing Secure Networking and Computer Systems	
ITEC 5103 [0.5]	Cloud and Datacentre Networking	
ITEC 5205 [0.5]	Design and Development of Data-Intensive Applications	
ITEC 5910 [0.5]	Special Topics in Network Technologies	
4. 0.5 credit in the area of the specialization, approved by the graduate supervisor or the Associate Director of Graduate Studies in the School.		0.5
5. 1.5 credits in electives at the 5000-level, chosen in consultation with your graduate advisor/supervisor or the Associate Director of Graduate Studies in the School.		1.5
Total Credits		**5.0**

Admission

Networking Technology - M.A.Sc., M.N.T.

Students entering the program will have an undergraduate degree in network technology, electrical engineering, computer science, engineering, or a closely-related discipline.

All students will apply for either the 5.0 credit M.A.Sc. or the M.N.T.

Applicants with substantial professional experience in network technology in Canada may be considered for admission to professional entry, requiring them to complete 4.0 credits, to be determined by the School of Information Technology and Graduate Studies.

Accelerated Pathway Networking Technology

The accelerated pathway in the M.A.Sc. Networking Technology and M. Networking Technology is a flexible and individualized plan of graduate study. Students in their final year of any relevant Carleton undergrad degree with demonstrated academic excellence and aptitude for research may qualify for this option.

Students in their third or fourth year in the relevant degree should consult with both their Undergraduate Program Coordinator and the CSIT Associate Director for Graduate Studies to determine if the accelerated pathway is appropriate for them and to confirm their selection of courses for their final year of undergraduate studies.

Accelerated Pathway Requirements:

1. At least 0.5 credit from: ITEC 5110, ITEC 5111, ITEC 5112, ITEC 5113, ITEC 5114 with a grade of B+ or higher;
2. Minimum overall CGPA of A-.

Students may receive advanced standing with transfer of up to 1.0 credit, which can reduce their time to completion. *Students presenting a demonstrated research ability (e.g. primary author of a research report), supported by the proposed thesis supervisor, and approved by the CSIT Associate Director for Graduate Studies, may be eligible to receive credit for ITEC 5002 [0.5 credit] Fundamentals of Information Technology Research.*

Regulations

See the General Regulations section of this Calendar.

Information Technology (ITEC) Courses

ITEC 5001 [0.0 credit]
Information Technology Seminars
A seminar based course where the students make the presentations and participate in discussions. Some seminars done by guest lecturers. Graded Sat/Uns.
Includes: Experiential Learning Activity

ITEC 5002 [0.5 credit]
Fundamentals of Information Technology Research
Basic concepts and techniques in information technology, including information systems, algorithms and software development process, research methods, and research and technical writing.
Includes: Experiential Learning Activity
Precludes additional credit for ITEC 5000 (no longer offered).

ITEC 5010 [0.5 credit]
Applied Programming I
Algorithm design and computer programming with practical industry problems in information technology. Topics include algorithms and pseudocode, programming fundamentals, memory operations, data structures, object oriented programming, program design, testing and debugging.
Includes: Experiential Learning Activity
Prerequisite(s): permission of the graduate supervisor.

ITEC 5100 [0.5 credit]
Planning and Design of Computer Networks
Planning process of computer networks; needs and technical requirements; modeling of different network planning problems; exact and approximate algorithms; topological planning and expansion problems; equipment (switch, router) location problem; approximate and optimal routing algorithms; presentation of various case studies.
Includes: Experiential Learning Activity

ITEC 5101 [0.5 credit]
Cross Layer Design for Wireless Multimedia Networks

Quality of service measures at different layers. Parameter adaptation, trade-offs, and optimization at physical, data-link, network, transport, and application layers. Cross-layer design in cellular, ad hoc, sensor, local area, green, and cognitive radio networks.

ITEC 5102 [0.5 credit]
Designing Secure Networking and Computer Systems

Network security with coverage of computer security in support of networking concepts. Security issues in data networks at different protocol layers. Routing security, worm attacks, and botnets. Security of new mobile networks and emerging networked paradigms such as social networks and cloud computing.

ITEC 5103 [0.5 credit]
Cloud and Datacentre Networking
Special issues of the networking requirements in datacentres and cloud computing environments. Performance, power requirements, redundancy of datacentre networks.

ITEC 5110 [0.5 credit]
Emerging Network Technologies
Overview of technologies, protocols and techniques related to Information Technology networking that are either in their early stage of adoption or are not yet mainstream (i.e. beta or prototype stage). Focus will vary from year to year to reflect the evolutionary nature of this domain.
Prerequisite(s): permission of the graduate supervisor.
Also offered at the undergraduate level, with different requirements, as NET 4000, for which additional credit is precluded.

ITEC 5111 [0.5 credit]
Multimedia Networking
Audio and video compression. H.261, JPEG, MPEG and DVI. Accessing audio and video from a web server. Real Time Streaming Protocol (RTSP). Multimedia operating systems. Multimedia database. Network support for multimedia applications. Multimedia synchronization.
Prerequisite(s): permission of the graduate supervisor.
Also offered at the undergraduate level, with different requirements, as NET 4007, for which additional credit is precluded.

ITEC 5112 [0.5 credit]
Secure Mobile Networking
The concept, principle and rationale of mobile networking. Mobile network architecture, protocols, mobility management, routing and mobile TCP/IP; Security challenges, vulnerabilities and threats in mobile networks; Security defense techniques and countermeasures in mobile networks.
Prerequisite(s): permission of the graduate supervisor.
Also offered at the undergraduate level, with different requirements, as NET 4010, for which additional credit is precluded.

ITEC 5113 [0.5 credit]
Network Simulation
Introduction to discrete event simulation; fundamental stochastic models for networking; queueing theory; deterministic algorithms for networking; confidence intervals; introduction to network modeling. Simulation exercises including traffic monitoring, congestion, routing protocols, resource utilization and growth planning using OPNET simulation tool.
Includes: Experiential Learning Activity
Prerequisite(s): permission of the graduate supervisor.
Also offered at the undergraduate level, with different requirements, as NET 4001, for which additional credit is precluded.

ITEC 5114 [0.5 credit]
Networked Applications
Architectures for computing in modern data networks that adopt the Internet architecture. Topics covered include socket programming, RPC and RMI. Client-server and peer-to-peer models. Emerging application architectures.
Prerequisite(s): permission of the graduate supervisor.
Also offered at the undergraduate level, with different requirements, as NET 4005, for which additional credit is precluded.

ITEC 5200 [0.5 credit]
Entertainment Technologies
Advanced topics in entertainment technologies which may include web-based, film and television, video games and/or interactive systems.

ITEC 5201 [0.5 credit]
Computer Animation Technologies
Advanced topics in computer animation: full body motion capture, space-time systems, physics-based animation, realistic rendering techniques, industry methods for large scene animations and live action integration; behavioural animation.

ITEC 5202 [0.5 credit]
Visual Effects Technologies
Advanced look at the processes and technologies in visual effects, specifically in advanced processing of virtual sets (e.g. using chroma-keying), lighting and colour integration, filming technologies, motion tracking, and the integration of 3D objects/elements into real scenes.

ITEC 5203 [0.5 credit]
Game Design and Development Technologies
Advanced technologies in the development of computer game systems and gameplay experiences, focused on Procedural Content Generation. Automatic or semi-automatic methods for producing game levels, objects, characters, and narratives.

ITEC 5204 [0.5 credit]
Emerging Interaction Techniques
Advanced interaction styles and their associated technologies. Topics may include hand held and gestural interactions, ubiquitous computing, deformable user interfaces, physiological computing and tangible user interfaces.
Also listed as HCIN 5300.

ITEC 5205 [0.5 credit]
Design and Development of Data-Intensive Applications
Design and development of data-intensive applications dealing with large-scale data. Data may include spatial data, time series, text, social media and different forms of digital media. Data modeling and management techniques will be discussed that enhance data analysis techniques and improve data-intensive applications.

ITEC 5206 [0.5 credit]
Data Protection and Rights Management
Understanding how to use technology to implement data privacy, security, protection and related legal issues. Insights on how to develop systems for managing digital rights, data privacy rules, laws or policies relevant to different jurisdictions, rights, and responsibilities for protecting data and personal information.
Precludes additional credit for DATA 5002.

ITEC 5207 [0.5 credit]
Data Interaction Techniques
Design and development of how humans (e.g., end-users, knowledge-users and expert-users) interact with data ecosystem like data collection, storage, analysis and visualization. Techniques, methods and tools will be discussed on how humans interact with data based on capabilities of machines and needs of humans.

ITEC 5208 [0.5 credit]
Virtual Reality and 3D User Interfaces
Research in and design of virtual reality and 3D systems. Applications, history, human factors, display and input hardware, and interaction techniques for navigation, selection and manipulation. Students develop and evaluate a VR or 3D system using game engines and devices such as head-mounted displays.
Includes: Experiential Learning Activity
Also listed as HCIN 5501.

ITEC 5209 [0.5 credit]
Empirical Research Methods in HCI
Advanced quantitative methods and conducting controlled user studies, statistically analyzing and reporting results in a research paper. Topics include history of empirical HCI, experiment design, hypothesis testing, interaction models, and scientific writing. Students complete a term-long research project.
Includes: Experiential Learning Activity
Also listed as HCIN 5407.
Also offered at the undergraduate level, with different requirements, as ITEC 4021, for which additional credit is precluded.

ITEC 5900 [0.5 credit]
Directed Studies
A course of independent study that fits the student's area of interest under the supervision of a faculty member of the School.

ITEC 5909 [2.5 credits]
Master's Thesis
Includes: Experiential Learning Activity

ITEC 5910 [0.5 credit]
Special Topics in Network Technologies
Recent and advanced topics in network technologies. Trends in wireless networking, software defined networks, power-line networking. Students may be expected to contribute to lectures or seminars.

ITEC 5920 [0.5 credit]
Special Topics in Digital Media
Recent and advanced topics in Digital Media. Students may be expected to contribute to lectures or seminars.

ITEC 6200 [0.5 credit]
Introduction to Interdisciplinary Research in Information Technology
Introduction to concepts and practices for research in Information Technology. Understanding the defining properties of computer-based systems and related technologies. Emphasis on bringing together skills related to technology, people and content in order to solve problems and explore new possibilities.

ITEC 6900 [0.5 credit]
Directed Studies
A course of independent study that fits the student's area of interest under the supervision of a faculty member of the School.

ITEC 6907 [0.0 credit]
Doctoral Qualifying Examination
Ph.D. qualifying examination in the student's field.
The exam consists of a written submission and an oral examination.

ITEC 6908 [0.0 credit]
Doctoral Proposal
Ph.D. thesis proposal. Defending a proposal consists of a written submission and an oral examination.
Prerequisite(s): ITEC 6907 and permission of the School.

ITEC 6909 [0.0 credit]
Doctoral Thesis
Includes: Experiential Learning Activity
Prerequisite(s): ITEC 6908 and permission of the School.

ITEC 6920 [0.5 credit]
Selected Topics in Digital Media
Recent and advanced topics in Digital Media. Students are expected to contribute to lectures or seminars.