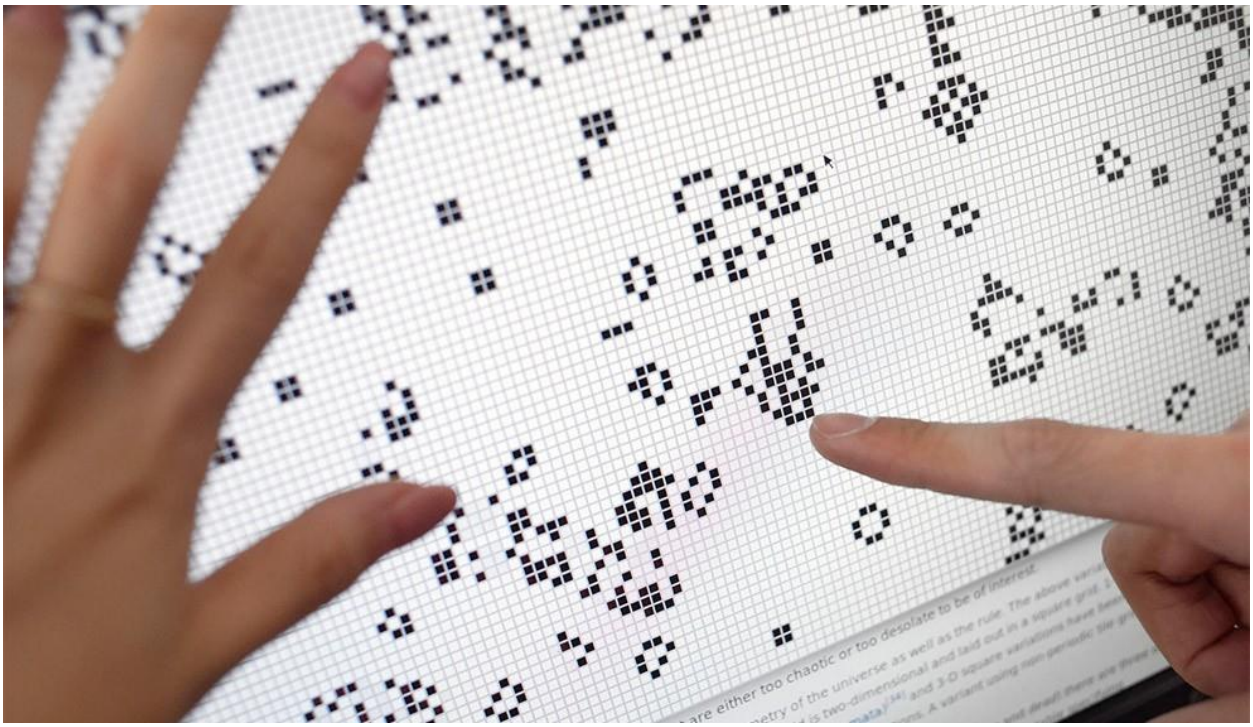
NEW YORK INSTITUTE OF TECHNOLOGY

COLLEGE OF ENGINEERING & COMPUTING SCIENCES:
MASTER OF SCIENCE IN CYBERSECURITY



15/06/2021

New York Institute of Technology
Vancouver Campus
M.S. in Cybersecurity
Application for New York Tech – Vancouver Degree
Consent Renewal- Program Proposal – Volume I

Volume 1. Application for NYIT-Vancouver Cybersecurity Degree Consent Renewal

Contents

Volume 2 - Appendices

1 Executive Summary

New York Institute of Technology, established in the State of New York in 1955, is an independent, coeducational, comprehensive, not-for-profit institution of higher education. It is a global university, serving a student population of approximately 9,000 students worldwide through undergraduate and graduate programs offered through the Schools of *Architecture and Design*, *Education*, *Health Professions*, *Management*, and the *Colleges of Engineering and Computing Sciences*, *Osteopathic Medicine* and *Arts and Sciences*. It offers 90 degree programs in more than 50 fields of study. Today there are more than 100,000 NYIT alumni worldwide.

New York Tech has earned an international and national reputation for excellence. It has been recognized, for the 21st consecutive year, as a top regional university by **U.S. News & World Report**. In the most recent *The Wall Street Journal / Times Higher Education* college rankings, New York Tech's overall ranking moved up to No. 266 nationally from No. 396 last year. The 130-point jump puts NYIT in the top third of the 801 universities represented in the rankings. In comparing New York Tech's 2020 scores to years past, the university ranked significantly better in two pillars: resources (faculty per student and finance per student) and outcomes (graduation rate and salary). It maintained its high ranking among all institutions in the environment category, indicative of its commitment to diversity and inclusion.

New York Tech has three campuses in the United States (Old Westbury, Manhattan, N.Y., and Jonesborough, Arkansas) and through its global campuses and collaborations, it has offered programs in Canada, the UAE, and China. New York Tech has operated academic programs in Vancouver, British Columbia since 2000.

Although New York Tech operates in multiple locations, it is chartered as a single institution, governed by a single 16-member Board of Trustees. In June 2017, it welcomed its fourth President, Dr. Henry C. Foley. Reporting to President Foley are members of the President's Council, who are responsible for academics, operations, long-range planning, and other administrative functions.

New York Institute of Technology (New York Tech) Vancouver campus seeks to have an external expert panel review the program and provide guidance for improvement of its curriculum for the benefit of students. New York Tech was approved by the BC Ministry of Advance Education to offer the Cybersecurity program in 2013 and is currently delivered at the Broadway Tech Campus at 2985 Virtual Way. The goal of the program is to prepare career-ready graduates who have a comprehensive understanding of cybersecurity. The program also benefits from New York Tech's strong reputation in cybersecurity education and research including its recent designation by the US National Security Agency and Department of Homeland Security as a National Center of Excellence in Cyber Defense Education.

Since the initial consent (2013), the Cybersecurity program at the New York Tech-Vancouver campus has experienced rapid growth. Cybersecurity student enrollment grew from 12 students for the 2013-2014 academic year to 252 students in the current academic year. To address this unprecedented growth, the campus has put in place new admission requirements designed to make the admission process more competitive and improve the quality of student performance. The entire campus enrolment at New York Tech-Vancouver has quadrupled in the same period of time and significant new administrative staff resources have been added to help support the growth in student numbers.

The Cybersecurity program offered at New York Tech-Vancouver is supported by six full-time faculty members, several qualified adjuncts, and supplemental faculty resources from New York.

An additional full-time faculty member is being recruited to join the program in next academic year. The program is led by an Assistant Dean who doubles as a full-time faculty member.

The program has thirty credit hours and may be completed in 1.5 years of full-time study for students holding an undergraduate degree with sufficient depth in computer science.

1.1 Organizational Overview

In Canada, New York Tech-Vancouver currently offers four masters programs in *Cybersecurity*, *Energy Management*, *Instructional Technology* and *Business Administration*. New York Tech Vancouver's Master of Science in Cybersecurity degree program was originally granted consent by the BC Ministry of Advanced Education in 2013. The program reflects both the strengths of New York Tech as a provider of profession-ready technology graduates and the needs of British Columbia (BC) residents for tertiary education in support of a knowledge-based economy.

1.2 Mission Statement and Academic Goals

The mission of New York Institute of Technology is to:

- Provide career-oriented professional education;
- Offer access to opportunity to all qualified students; and
- Support applications-oriented research that benefits the larger world.

This program supports the institution's mission and academic goals by delivering a highly relevant graduate program that produces graduates who are ready to begin challenging new careers.

1.2.1 Aims, Goals and/or Objectives

New York Tech began offering the ***Master of Science in Cybersecurity*** at the New York campuses in 2005, and in Vancouver in 2013. Students in the New York Tech program in Vancouver receive the same curriculum as in New York, contextualized for British Columbia, and receive the same degree as do New York Tech students in the program on other New York Tech campuses. The New York program has a thesis option for students who may wish to prepare for further graduate work while the Vancouver program focuses on preparing students for immediate entry into the local technology workforce.

Since 2005, the Cybersecurity program has been educating hundreds of students and professionals on the study and application of computer and network security concepts and tools essential to defend organizations and government agencies against cyber-attacks. The program is housed in the department of Computer Science of the College of Engineering and Computing Sciences (CoECS).

The program addresses aspects of security from network structure to application interfaces, providing a comprehensive understanding of security and its implications on networks, web services infrastructure, databases, and software design. The specific areas of study include, but are not limited to, best practices in security, operating system security, cryptography, network protection, and intrusion detection.

The degree is designed for students with engineering, computer science or related backgrounds who intend to play a leading role in the implementation, as well as the management, of computer and network security systems. All instructors at the New York Tech-Vancouver campus are members of the New York Tech faculty and are held to the same professional standards as New York Tech faculty in New York.

Students are strongly attracted to the Cybersecurity program because it allows them to study and gain skills in the constantly evolving field of cybersecurity. The program offers them the opportunity to study in Vancouver with highly qualified faculty in the heart of the city's high-tech

community. As graduates of an eligible high-tech program, Cybersecurity students are eligible for express entry immigration to Canada under the terms of the Provincial Nominee Program (PNP).

1.2.2 Program Learning Goals

The Program Learning Goals of the MS in Cybersecurity are:

1. Identify, formulate, and analyze the patterns and trends of threats as they apply to information systems, including methods, modes of preparation for attack, tactics, logistics, hazards, and vulnerabilities
2. Critically evaluate various technical/architectural solutions available to limit risk, mitigate the effects of hostile action and recover from attack
3. Design, implement and maintain software tools designed to support network security and systematically integrate these tools within multiple operating systems and platforms
4. Oversee the information assurance life cycle of an organization, including planning, acquisition, and implementation of secure infrastructures
5. Ensure compliance with security policy, legislation and market trends
6. Utilize mathematical and algorithmic solutions to complex information security problems
7. Develop a comprehensive knowledge of probability and statistics

1.2.2.1 Content Mastery

The curriculum is comprised of 30 credit hours and divided into two areas: Required Fundamental Core consisting of eight courses (24 credits), Elective and Project Courses (6 credits), geared to the students' individual interests and professional goals. All required courses within the program have been customized to have reading requirements directly applicable to the Canadian cybersecurity requirements[1]. Required and elective courses are designed to contain examples and scenarios which are contextualized into applications-oriented areas such as: Health, Finance/Banking/e-Commerce, and Utilities/Energy.

All students complete at least one 3-credit hour Project course. In these capstone project courses, INCS 870 and 880, students are expected to investigate a relevant topic and then report their findings. During the semester, students meet with their advisor on a weekly basis, indicating progress and presenting a documentation of their progress. The course deliverable is a final project report documenting project progress and findings.

For a complete listing and description of the course syllabi, please see Appendix 4: Course Syllabi.

1.2.3 Career Relevance

All courses, learning goals, and learning outcomes are externally referenced. That is, all are reviewed, evaluated, and endorsed by industry advisory groups for the purpose of ensuring high relevance to workforce expectations. The program has an active Industry Advisory Board with membership from the local cybersecurity industry. [2]

[1] *Appendix 4*
[2] *Appendix 17*

1.2.4 Student Engagement

The New York Tech Cybersecurity experience in New York and Vancouver is enhanced through opportunities for students to become fully engaged:

Professional Enrichment Program – Students are sponsored to attend and encouraged to participate in the Cybersecurity conferences that are held annually in the community e.g., BSides Vancouver, BC Aware and the Vancouver International Privacy and Security Summit (VIPSS).

Our students also participate regularly local and national cyber defense challenges and hackathons. In 2021 our students participated in the Vancouver regionals of the Canada CyberSCI Challenge finishing in 4th place. They also participated in the Canada Cyber Defense Challenge finishing in 3rd place. Participating in these competitions gives the students an opportunity to put into practice what they learn in the classroom and make vital networking contacts with potential employers.

To enhance the employment readiness of our graduands, we have introduced an optional CISSP (Certified Information Systems Security Professional) training seminar. The CISSP certification remains one of the most respected vendor-neutral certifications in the cybersecurity industry. The seminar is 5-day full day bootcamp which prepares participants to write the certification exam. Students who take the seminar are ready to write the CISSP certification exam soon after graduation, enhancing their chances of securing employment in cybersecurity industry.

Students are encouraged to collaborate and consider publishing the results of their project work in reputable conferences. There are many of examples of this, as is this example published in the 2020 DSN Conference. [3]

Personal Enrichment – The Student Engagement Coordinator provides a year-long series of Campus Life Events for New York Tech-Vancouver students. These activities are designed to help our students experience the unique social, cultural and recreational opportunities that are available in the greater Vancouver area and around the province. Despite the constraints brought on by the COVID pandemic, the coordinator continues to organize events, mostly virtually. [4]

Possible career opportunities for graduates with this degree include:

- AI scientist
- Cybersecurity expert
- IT director
- Network specialist
- Research and development expert
- Software engineer

In March 2017, the BC Tech Association published the 2016 TechTalentBC Report.

The report notes that British Columbia has established itself as one of the leading tech ecosystems in the country, boasting a host of successful companies in information and communications technology, interactive and digital media, cleantech, life sciences, and engineering services. Growing by a compound annual growth rate (CAGR) of 6% over a 10-year period ending in 2014, BC's tech sector revenue growth has outpaced the tech sector revenue growth in Ontario and Québec.

Spurred by business growth and employer demand for top talent, BC's tech sector employment,

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[3] S. M. Fattahi, A. Makanju and A. Milani Fard, "SIMBA: An Efficient Simulator for Blockchain Applications," 2020 50th Annual IEEE-IFIP International Conference on Dependable Systems and Networks-Supplemental Volume (DSN-S), 2020, pp. 51-52, doi: 10.1109/DSN-S50200.2020.00028

[4] Appendix 3 Campus Life Events 2020-2021

defined in this report by 32 key occupations, reached approximately 149,000 jobs in 2015, and is on pace to grow to more than 165,500 by 2021, adding 16,500 net new jobs at an average annual growth rate of 1.8%.

Demand for talent is most acute for a collection of information technology-centric roles, including systems engineers, programmers, and software developers. The rapid expansion of the BC tech sector will result in a demand for more than 47,000 additional workers by 2021. However, based on the current employment growth and talent availability numbers, only 16,500 of these vacancies will be filled. 30,500 tech-related job openings will remain vacant. 12,500 more graduates from BC post-secondary institutions will be needed by 2021 to meet tech sector demand.

The [(ISC)² Cybersecurity Workforce Study] is an annual report that assesses the state of the global cybersecurity workforce and the talent gaps. The 2020 edition of the report states that the size of the Cybersecurity workforce in Canada to be 101,963 with a gap of 16,552 in 2020. This workforce shortages are putting the security of several organizations at risk.

1.2.5 Industry Engagement

NY Tech-Vancouver is committed to building strong relationships with the technology and business community in Vancouver to ensure we understand their needs. In 2017 New York Tech-Vancouver initiated an industry engagement consultation with the local Vancouver high-tech community. The consultation was designed to strengthen New York Tech's relationship with the tech community and allowed the institution to hear directly from employers about their individual training needs. Twenty companies provided input as part of the consultation process. They represented a cross section of the dynamic tech sector in the greater Vancouver area. The companies were small, medium and large players in the tech sector. They included recent start-ups, well-established enterprises and a mix of locally owned and multinational companies.

The companies provided New York Tech-Vancouver with a clear picture of the existing and emerging training needs in the high-tech sector. [5] During the consultation process, New York Tech-Vancouver developed a stronger relationship with several key employers involved in the provision of internet security services.

The consultation also identified many companies in the Vancouver area who offer co-op and internship placements to students. This has been identified as an area where the Cybersecurity program can be strengthened by creating new opportunities for students to engage directly with local employers.

We have since launched, in 2020, our Internship Certificate Program (ICP) that allows students to go on work terms of 4 – 8 months during the program. The ICP is competitive and is only open to students that apply. The first batch of students from the Cybersecurity program started their internships in January 2021 and we currently have four students on internships as at May 2021.

1.2.6 Delivery Methods

The majority of New York Tech's Cybersecurity program in Vancouver is delivered in a traditional in-class format; however, when suitable, a blended online/intensive format is offered to allow students the opportunity to study with experienced senior faculty from the New York campuses. Due to the current situation with the COVID-19 pandemic, most of our traditional in-class format classes are currently held in an online synchronous format.

Delivery and instruction is by qualified full-time and adjunct faculty based in Vancouver,

[5] *Appendix 1: Employer Engagement Summary*

supplemented by additional full-time faculty based in New York. The latter work collaboratively with Vancouver faculty in terms of assuring overall quality of instruction, sharing of course outlines and content, as well as pedagogical currency. The Assistant Dean of the College of Engineering and Computing Sciences in Vancouver is responsible for all decisions concerning the selection of courses to be offered and the allocation of faculty course assignments each semester. Faculty loads and course release for scholarship or alternative assignments are developed in accordance with standard faculty workloads, as per Ministry's regulations, and commensurate with responsibilities.

1.2.7 Contact Information

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2 Degree Level Standard – Master of Science in Information, Network Computer Security

2.1 Depth and Breadth of Knowledge

The curriculum is comprised of 30 credit hours and divided into three areas: Required Fundamental Core consisting of eight courses (24 credits), Elective and Project courses (6 credits). All required courses and elective courses within the program have been customized to have reading requirements directly applicable to the Canadian cybersecurity requirements. Required and elective courses are designed to contain examples and scenarios which are contextualized into applications-oriented areas such as: Health, Finance/Banking/e-Commerce, and Utilities/Energy.

The curriculum is organized to provide a sound academic progression, a balance between theory and practice, and a suitable student workload, as recommended in the degree map shown later in Section 4 ***"Curriculum/Program Content".*** The school and program have built-in mechanisms to continuously monitor and ensure compliance and currency in the curriculum. Curriculum revisions are expected as new information, technology and pedagogical approaches evolve. Courses and syllabi reflect substantive changes to keep abreast of new research in the field. Faculty in New York and Vancouver are responsible for ensuring that content reflects the changing landscape of both the scope of practice as well as the content.

The faculty in Vancouver have recently developed three new elective courses that are delivered as using the INCS 810: Special Topics in Computer Security Course. The courses are *Cloud Security and Design Patterns*, *Blockchain Application and Security* and *Privacy in Health Informatics*. These courses have been developed with input from the program's Industry Advisory Board (IAB).

To keep abreast with trends in the industry, the course INCS 615, will starting in. Fall 2021 no longer be called *Network Security and Perimeter Protection* but will be called *Advanced Network and Internet Security*. This reflects the current trend of migration to the cloud that is being witnessed in enterprise networks.

For all catalog course descriptions, as well as a complete listing of the course syllabi, please view Appendix 4: Course Syllabi.

2.2 Program Course Requirements

Required Fundamental Core

- CSCI 620 Operating System Security,
- CSCI 651 Algorithm Concepts,
- INCS 618 Computer Security Risk Management and Legal Issues,
- INCS 615 Network Security and Perimeter Protection,
- INCS 741 Cryptography,
- INCS 745 Intrusion Detection and Hacker Exploits,
- INCS 712 Computer Forensics,
- INCS 775 Data Center Security

Electives

- CSCI 690 Data Networks
- CSCI 657 Data Mining,
- CSCI 662 Information Systems Security Engineering and Administration,
- CSCI 675 Simulation Techniques,

- INCS 735 Secure Software Engineering,
- INCS 810 Special Topics in Computer Security

Project Courses

- INCS 870,
- INCS 880

2.3 Course Level

Each course is designed to sufficiently cover a broad scope of topics to provide students with an appropriate level of familiarity with the state of the art in that particular subject. Simultaneously, in each course, certain topics of particular importance are covered in substantial depth commensurate with a graduate level course. E.g., in the course INCS 741, Cryptography, while all the categories of crypto algorithms are introduced and discussed, only modern block ciphers that are standardized, as well as standardized public key ciphers are covered analytically in great depth.

2.4 Application of Knowledge

Emphasis is placed, where appropriate, on applications that tie the theory learned to real world situations. This is done in practice through the utilization of computer resources and other technology tools to solve computer security problems, through examples, homework and project assignments with input from industry. The majority of courses are designed to weave in real-world applications of fundamental theories throughout. For example, in the course CSCI-620 Operating Systems Security, each chapter covering the theory of a secure operating system is followed by a hands-on project applying the concepts learned to a Linux strength or vulnerability.

The two courses INCS 870 Project I, and INCS 880 Project II, are designed for the students to propose a project, and under mentorship of the course instructor, carry on a semester-long substantial project in the field of cybersecurity. The elective course, INCS 810 Special Topics in Computer Security allows students to study the latest emerging trends in cybersecurity with a professor who is active in the field.

2.5 Communication Skills

All courses emphasize written and oral communication skills. The integration of team projects ensures that communication skills are strengthened and reinforced, all within an applied context[6]. The majority of courses require students to prepare written subject reports and present technical topics in formal and semi-formal settings. A number of required courses (CSCI 620, INCS 741, INCS 712, INCS 745), have built-in projects that require students to present their projects either in written form, or both in written and oral forms. The two project courses are designed so that students will develop the ability to communicate in a fluid and comprehensible manner about complex technical topics.

2.6 Awareness of Limits of Knowledge

There is a defined emphasis on "evaluation" in the program's learning goals, which includes alternative perspectives, limitations of the analysis used, and effectiveness of proposed solutions. The goal of all course syllabi is to provide a clear understanding of the state of the art particularly for advanced courses such as INCS 741, INCS 745, and INCS 712. In these courses, students are required to read and analyze scholarly papers on leading edge developments in the field. E.g., In the course INCS 741, students are required and write papers on topics such as Post-Quantum

[6] *Appendix 4: Course Syllabi*

Cryptography and Homomorphic Encryption.

2.7 Professional Capacity/Autonomy

Qualities and transferable skills necessary for further study, employment, community involvement and other activities requiring:

2.7.1 The exercise of initiative, personal responsibility and accountability in both personal and group contexts

Embedded in several courses[7] and projects taken by students, there are a number of underlying principles emphasized by the faculty, and expected of students in achieving the program outcomes. These principles include: the intellectual independence required for continuing professional development; the qualities and transferable skills necessary for employment requiring the exercise of initiative and of personal responsibility and accountability, as well as decision-making in complex situations; the ethical behavior consistent with academic integrity and the use of appropriate guidelines and procedures for responsible conduct of research; and the ability to appreciate the broader implications of applying knowledge to particular contexts.

2.7.2 Working effectively with others

Teamwork is emphasized throughout the curriculum[8]. Whenever possible, students are broken into groups within lecture courses to collaborate on specially designed active learning exercises. Both in courses and projects within several courses, (CSCI 620, INCS 741, and INCS 745), students work in groups. The two project courses (INCS 870 and INCS 880), often require students to work in teams for the duration of the semester. Effective team work is monitored and assessed by the instructor.

2.7.3 Behavior consistent with academic integrity

Students and faculty are presented with the academic and student life policies during their regular orientations respectively. New York Tech has an extensive academic integrity policy, with definitions of various types of infractions, including plagiarism, cheating, misrepresentation, etc. Students are told that they can find the academic integrity policy embedded within the general student handbook. That handbook is available online at: https://www.nyit.edu/policies/collection/student_handbook_global_edition#academic_integrity_policy_preamble

Faculty have access to the academic integrity policy through the Academic Affairs webpage.

In addition, the New York Tech Library adheres to the "Academic Integrity" standard published in the Student Handbook. Furthermore, the Center for Teaching & Learning offers online tutorials on the use of anti-plagiarism software such as Turnitin or SafeAssign .

Since 2014, New York Tech-Vancouver has had a Learning Specialist whose responsibilities include providing detailed seminars on plagiarism which all students are required to attend.

2.7.4 Process to maintain currency of faculty and courses

As illustrated in the section addressing faculty, New York Tech has a well-defined set of resources available to the faculty, along with a documented process that describes expectations of the faculty in maintaining their technical and professional currency. The promotion and reappointment

[7] *Appendix 4: Course Syllabi*
[8] *Appendix 4: Course Syllabi*

criteria outlined in New York Tech's Guidelines for Global Faculty [9] clearly indicate that New York Tech puts significant emphasis on a continuous improvement process for its' faculty. We also provide research grants to encourage and enable quality research from our faculty[10]. The evaluation process looks at criteria such as how well faculty members are able to assess student learning and integrate new developments in their field into current teaching activities.

The section on assessment describes the rigorous process in place to assess student learning.

[9] *Seehttps://www.nyit.edu/policies/collection/faculty_handbook_global_campuses#*
[10] *See Appendix 11*

3 Credential Recognition and Nomenclature

3.1 Credential Recognition

The College of Engineering and Computing Sciences (CoECS) has 27 programs11 including 2 Master's programs in Vancouver: Cybersecurity and Energy Management. A Vancouver Master of Science in Data Science is also being proposed. NY Tech launched a PhD in CS in 2020. Four bachelor programs (Electrical and Computer Engineering, Electrical and Computer Engineering Technology, Mechanical Engineering Computer Science) are accredited by the Accreditation Board for Engineering and Technology, Inc. (ABET12). ABET accreditation is recognized by the International Standards Organization (ISO) and international entities including Engineers Canada (EC), Canadian Information Processing Society (CIPS) and the Canadian Council of Technicians and Technologists (CITT). ABET is responsible for accrediting programs in 767 institutions in over 30 countries. For decades, CoECS graduates the have found jobs in CS and IT, mechanical and electrical engineering and more. Others attend advanced study world-wide. This demonstrates the recognition of our programs.

The Master of Science in Cybersecurity is a well-established degree and New York Tech was first authorized to award it by the New York State Department of Education in 2005. New York Tech-Vancouver has been authorized to offer the degree in British Columbia since 2013.

External reviews validate the quality of the academic program, curriculum and intended learning outcomes, and ensure that the credentials and learning outcomes are recognized by and meet the standards of industry and regulatory licensing, or credentialing bodies. The last meeting of the New York Tech-Vancouver Cybersecurity Industry Advisory Board was on April 16, 2021[13].

At the institutional level, the program is subject to internal annual assessment reviews led by the offices of Research, Assessment, and Decision Support[14] and the Office of Institutional Effectiveness[15], which are led by Dr. Michael Lane and Dr. Shifang Li respectively *(Also see Section 10: Program Review and Assessment)*

3.2 Nomenclature

The name of "Master of Science in Cybersecurity" is consistent with names of degrees with similar outcomes and content across Canada and the world. "Master of Science" is a generic name that incorporates a range of disciplines and is commonly used at the graduate level. The degree name was clear and recognizable to stakeholders consulted.

The name also aligns with the *Guidelines* in DQAB's *Degree Program Review Criteria and Guidelines*, namely:

1. The degree name is not new. Similar degrees with the same name are offered by several institutions in Canada and around the world.
2. The degree name is generic enough and does not relate to any specialization
3. The degree name fits in well with names of other programs offered by NY Tech's CoECS,

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[11] undergraduate and graduate

[12] The undergraduate degrees of offered in the United States. In Canada, engineering degrees are accredited by CEAB. .

[13] Appendix 18: Industry Advisory Board

[14] See https://www.nyit.edu/planning

[15] See https://www.nyit.edu/planning/institutional_effectiveness

specifically the Bachelor of Science in Computer Science and the PhD in Computer Science

4. The need for adoption does not arise.
5. The degree name is not for an associate degree
6. The degree name is intended for a graduate-level program

4 Curriculum/Program Content

4.1 Structure and Length

The INCS program consists of a set of core courses (24 credit hours), and 6 hours of elective and/or project courses. The program, with a total of thirty (30) credit hours may be completed in 1.5 years of full-time study.

4.2 Degree Map

Core Courses	Elective Courses	Project Courses
All students must complete this 24-credit hour core requirement All courses are 3.0 credit hours unless specified otherwise.	All students must complete at least one project course and at least one elective for a total of 6 credit hours	
CSCI 620 Operating System Security	**CSCI 657** Data Mining	**INCS 870** Project I
CSCI 651 Algorithm Concepts	**CSCI 662** Information Systems Security Engineering and Administration	**INCS 880** Project II
INCS 618 Computer Security Risk Management and Legal Issues	**CSCI 675** Simulation Techniques	
INCS 615 Network Securities and Perimeter Protection	**CSCI 690** Data Networks	
INCS 741 Cryptography	**INCS 735** Secure Software Engineering	
INCS 745 Intrusion Detection and Hacker Exploits	**INCS 810** Special Topics in Computer Security	
INCS 712 Computer Forensics		
INCS 775 Data Center Security		

4.3 Course Descriptions

CSCI 620 Operating Systems Security

In this course students are introduced to advanced concepts in operating systems with emphasis on security. Students will study contemporary operating systems including UNIX and Windows. Topics include the application of policies for security administration, directory services, file system security, audit and logging, cryptographic enabled applications, cryptographic programming interfaces, and operating system integrity verification techniques.

CSCI 651 Algorithm Concepts

Abstract Data Structures are reviewed. The course covers the study of both the design and analysis of algorithms. Design methods include: divide-and-conquer; the greedy method; dynamic programming; basic traversal and search techniques algebraic and geometric problems as well as parallel algorithms (PRAM). Space and time complexity; performance evaluation; and NP-Hard and NP-Complete classes are also covered. The purpose of this approach to the subject is to enable students to design and analyze new algorithms for themselves.

INCS 618 Computer Security Risk Management and Legal Issues

This course explores several domains in the Information Security Common Body of Knowledge. Students in this course will be introduced to the following domains within Information Security: Security Management Practices, Security Architecture and Models, Business Continuity Planning (BCP), Disaster Recovery Planning (DRP), Law, Investigations, Ethics, Physical Security, Operations Security, Access Control Systems and Methodology, Network and Internet Security.

INCS 615 Network Security and Perimeter Protection

In this course, students are introduced to the design of secure computer networks. Exploitation of weaknesses in the design of network infrastructure and security flaws in network protocols are presented and discussed. Network operation systems and network architectures are reviewed, together with the respective security related issues. Issues related to the security of content and applications such as emails, DNS, web servers are also addressed. Security techniques including intrusion detection, forensics, cryptography, authentication and access control are analyzed. Security issues in IPSEC, SSL/ TLS and the SSH protocol are presented.

INCS 741 Cryptography

In this course we introduce the students to key issues in cryptography. Topics covered include definitions of security, digital signatures, cryptographic hash functions, authentication, symmetric and asymmetric encryption, stream ciphers, and zero knowledge proof systems.

INCS 745 Intrusion Detection and Hacker Exploits

Methods used in computer and network hacking are studied with the intention of learning how to better to protect systems from such intrusions. Methods used by hackers include reconnaissance techniques, system scanning, and gaining system access by network and application level attacks, and denial of service attacks. The course will extensively study Internet related protocols, methods of traffic analysis, tools and techniques for implementing traffic filtering and monitoring, and intrusion detection techniques. Students will study common hacking and evasion techniques for compromising intrusion detection systems.

CSCI 690 Computer Networks

Connection of multiple systems in a networked environment. Topics include physical connection alternatives, error management at the physical level, commercially available protocol support, packet switching, LANs, WANs and Gateways.

CSCI 657 Data Mining

This course introduces the concepts, techniques, and applications of data mining. Topics include data preprocessing, clustering, data warehouse and Online Analytical Processing (OLAP) technology, cluster and social network analysis, data classification and prediction, multimedia and web mining.

CSCI 675 Simulation Techniques

The use of simulation methods for the analysis and design of various types of systems is discussed. The use of general purpose languages for simulation is covered along with the use of discrete and continuous simulation languages for probabilistic and analog systems.

CSCI 662 Information Systems Security Engineering and Administration

This course introduces students to a range of contemporary, applications oriented, and advanced technical aspects of information security and assurance. Topics covered in this course are: the need and planning for security, information security maintenance, security technology, cryptography, and physical security. The course will also cover security policies, and legal and ethical issues. The course will also include a special project or paper as required and specified by the instructor and the CoECS graduate committee

INCS 735 Secure Software Engineering

Developing software that is secure and robust requires the implementation of established methodologies in software engineering with a particular orientation towards security. This course introduces advanced topics in the methodology of secure software design, development and testing. Topics in enterprise as well as Web-based secure software development are discussed. Secure programming for operating systems, databases, Web servers, services and their frameworks are a few of the topics addressed.

INCS 712 Computer Forensics

Computer forensics is concerned with the post- analysis of computer systems that have already been compromised. Forensic tools and techniques combine information accumulated from various systems to reconstruct the behaviors and actions of cyber criminals. Computer forensics focuses on the reconstruction of events that have led to system corruption, with the goals of recovering critical data, aiding authorities in tracking those who may have caused the security breach, and learning techniques used by hackers to improve the protection of systems and prevent similar breaches in the future.

INCS 775 Data Center Security

Data Center Security is concerned with the study of computer architectures and systems that provide critical computing infrastructure. This infrastructure combines hardware devices including computers, firewalls, routers, switches, and software applications such as email systems, Web servers, and computer desktop operating systems, to implement and manage organization wide secure computing capability. Examples of critical systems include intranet, extranet, and Internet systems.

INCS 810 Special Topics in Computer Security

This course provides an opportunity for students to study advanced topics in computer security, which may not be included elsewhere in the curriculum. Students will undertake a significant hands-on security related project using New York Tech's Center for Network and Information Security laboratory facilities.

INCS 870 Project I

In this course students carry out independent research in a significant technical area of information, network, or computer security. The student will investigate a technical area, conduct research, and advance the current state of the art in some way if possible. A written report is required that summarizes the findings and any advancements made. Prior approval by a project advisor is required to register.

INCS 880 Project II

In this course students carry out either a continuation of an independent research started in INCS-870 or a new one in a significant technical area of information, network, and computer security. The student is to investigate a technical area, in a deeper detail and wider scope than the INCS-870, research it, advance it in some way if possible, and report on the learning and advancements made. A written report is required that summarizes the findings and any advancements made to the technology.

4.4 Program goals

In Vancouver, the New York Tech campus plan is tightly aligned with both the institutional mission, as well as the vision and mission of the College of Engineering and Computing Sciences. Consistent with the institutional mission and vision, the primary goals of the Master of Science in Cybersecurity program are to produce students with depth and breadth in the area of information, network, and computer security. The program's goal is to prepare students for careers and further graduate studies in computer science and computer security. This goal is supported by the program Learning Goals previously listed in section 1.2.2.

4.5 Review Process

Continuous improvement of the Cybersecurity curriculum is important. To this end the Cybersecurity program makes use of both external referencing and internal assessment data via input from (1) Industry Advisory Boards at different New York Tech locations, (2) Stakeholders (faculty, students, alumni and employers) conferences and (3) benchmarking with peer and aspirant institutions. This is a continuous multiyear process and more detail about the external referencing and internal assessment are provided in Section 9, "Program Consultation" and Section 10, "Program Review and Assessment".

5 Program Delivery / Learning Methodologies

5.1 Program Delivery

The program delivery is primarily through face-to face instruction. The master syllabi for each course [16] specifies which teaching and learning strategies will be employed including incorporation of technology, the internet, collaborative learning, industry engagement, problem-solving, project-based learning, in-class discussion, integrating ethics and social responsibility, time management, integrating career-related content, and independent learning.

Delivery of the courses are carried out by qualified full-time and adjunct faculty located in Vancouver and regularly supplemented by additional full-time faculty from New York. The latter work collaboratively with Vancouver faculty in terms of ensuring the overall quality of instruction, sharing of course outlines and content, as well as pedagogical currency. The Assistant Dean of the College of Engineering & Computing Sciences in Vancouver is responsible for all decisions concerning the selection of courses to be offered and the allocation of faculty course assignments each semester.

5.2 Learning Methodologies

In the program, faculty facilitate a student-centered learning environment that develops students' creativity and productivity. Both faculty and students have access to professional Google accounts, providing them access to enhanced Google applications features, including Google productivity tools. In blended or online classes, faculty are encouraged to use screen-capture software to create multimedia presentations and real-time video conferencing tools like Zoom to enhance the quality of interaction between faculty and students. In addition to the New York Tech e-library resources, faculty and students have access to a variety of resources to support pedagogical practices and student learning. Faculty use the Learning Management System CANVAS, supported at the New York Tech institutional level to increase the level of interaction between the instructor and the students and among the students outside the classroom[17].

Regardless of the method of delivery and strategy used, faculty engage the students in learning through assignments and projects, which apply theory to practice, and are geared to equip students with the knowledge and skills required to gain competency in their field of study. Homework assignments are mainly aimed at developing independent problem solving, while projects teach students how to work in teams and collaborate with one another towards solving more complex problems.

[16] *Appendix 4: Course Syllabi*

[17] *See example https://www.nyit.edu/administrative_offices/canvas*

6 Admission and Transfer/Residency

6.1 General

New York Tech general admissions requirements are described in the New York Tech Graduate Admissions page.

6.2 Program Specific

Applicants to the Master of Science in Cybersecurity must have the following:

- Hold a four-year bachelor's degree or its equivalent in computer science, information technology, engineering, math, or a related field from an appropriately accredited college or university.
- Have a cumulative GPA of at least 3.00 (out of 4.0) or equivalent.
- Receive a minimum score of 6.5 (IELTS), 88 (TOEFL IBT), or the equivalent for admission. Graduates from North American institutions and other English speaking countries may be exempt from English proficiency testing.
- Take the GRE at the discretion of the department.
- For additional details, please see appendices.[18]

In the 2017-2018 academic year, New York Tech-Vancouver began offering undergraduate Math and Computer Science course to help students complete their prerequisite requirements for the Cybersecurity program. Offering these courses has provided a more streamlined admission process for prospective students and provided the campus with an opportunity to improve the quality of prerequisites at admission.[19]

6.3 Transfers

Up to six transfer credits from an accredited graduate program may be granted to students in this program for appropriate courses in which a minimum grade of B was earned.

6.4 Residency requirements

Transfer students are required to take at least two semesters at New York Tech to get the MS in Cybersecurity degree.

6.5 Articulation agreements (actual or planned)

New York Tech-Vancouver has an articulation for the Cybersecurity program with the British Columbia Institute of Technology (BCIT). [20]

[18] *Appendix 5: Program Admission Requirements*
[19] *Appendix 5: Program Admission Requirements*
[20] *Appendix 6: BCIT-New York Tech Memorandum of Understanding*

7 Faculty

The College of Engineering and Computing Sciences is led by the Academic Dean, Dr. Babak Dastgheib-Beheshti. The dean is supported by an Associate Dean in New York and an Assistant Dean at each global location. [21] The Cybersecurity program in Vancouver is chaired by a full-time faculty member who assumes the role of Assistant Dean. The Cybersecurity program has six full-time faculty. One is an associate professor and the others hold the rank of assistant professor. One additional full-time faculty will be joining the program in the next academic year. Additional adjunct (part-time) faculty are recruited as needed to teach courses. For the Summer 2021 semester, the Cybersecurity program has seven adjunct faculty teaching Cybersecurity courses and prerequisite computer science courses. Two of the adjunct faculty are qualified at the doctoral level.

7.1 Faculty Qualifications

Any additional new-hire faculty must have earned a Ph.D. degree in Computer Science, Computer Engineering or Electrical Engineering. Other required attributes of the faculty to be hired include:

- Must be active members of professional societies.
- Must have a proven track record of teaching at the graduate level.
- Must be actively engaged in research.
- Must have scholarly activities demonstrated by their publications that match the program aims and curricular content. [22]

Faculty appointments are made by the College of Engineering and Computing Sciences' Academic Dean in New York following an analysis and review (including interviews) of candidates by the School Personnel Committee (SPC).

Faculty evaluations are in keeping with institutional processes documented in the New York Tech Global Faculty Handbook, as well as in the New York Tech Policies and Procedures page. An annual faculty evaluation (which impacts decisions on reappointment and promotion as well as professional development) is conducted by the Assistant Dean for each full-time faculty member, including a peer evaluation of teaching and other outcomes linked to teaching, scholarship, and service. The evaluation template (reference) is completed by the Assistant Dean and discussed collaboratively between the Assistant Dean, the faculty member, and the Campus Dean. Comments are welcomed from the faculty member concerning the evaluation. The resulting form and comments are then sent to the Academic Dean for review and evaluation.

The choice of and deployment of adjunct faculty members are made by the Assistant Dean, guided by the adjunct faculty members' teaching evaluations, and also the initial qualifications and maintenance of qualifications of the adjunct with respect to the school's standards for academically and professionally qualified faculty members. In addition, annual one-to-one planning meetings between the Assistant Dean and each full-time faculty member are held during which faculty goals in teaching, scholarship, and service for the upcoming year are discussed, faculty outcomes benchmarked against prior year's goals are reviewed, and specific recommendations are made to facilitate ongoing faculty development and success. Outcomes of these meetings are documented and maintained by the Assistant Dean on file.

The full-time faculty members in the NY campuses constitute the core technical and academic

[21] *Appendix 7: Roles and Responsibilities of Assistant Dean*
[22] *Appendix 8: Full-time and Adjunct Faculty*

expertise for all our global campuses. To this end, these faculty members available for mentoring, consultation and general resources to the Vancouver-based faculty.

7.1 New York Tech Policy on Academic Freedom

All faculty at NYIT work within the context of the institution's commitment to the principles of academic freedom. Instructors are entitled to freedom in the classroom in discussing their subject, but should be careful not to introduce into the teaching controversial matters that have no relation to the subject being taught.

NYIT instructors are citizens, members of a learned profession, and officers of an educational institution. When they speak or write as citizens, they should be free from institutional censorship or discipline, but their special position in the community imposes special obligations. As persons of learning and educational officers, they should be mindful that the public may judge the profession and the institution by these utterances. Hence, they should at all times be accurate, exercise appropriate restraint, show respect for the opinions of others, and make every effort to indicate that they are not institutional spokespersons.

The instructor is entitled to full freedom in research and in the publication of results, subject to the adequate performance of other academic duties; however, research for pecuniary return must be approved annually by the Vice President for Academic Affairs[23]

7.2 New York Tech Policy on Teaching Loads

Full-time faculty are contracted for a base teaching load of twenty-one credit hours instructed over three terms in each Academic year , less release time as commensurate with scholarship outcomes and alternative roles and responsibilities, including administrative assignments.

7.3 Professional Development for Faculty Members

With a mission specifying "career-oriented professional education" and "support for research and scholarship that benefit the larger world," scholarship is demonstrated in applied as well as traditional academic ways. Evidence of faculty scholarship at New York Tech includes research projects and grants, papers and publications, and other demonstrations of professional competence appropriate to a discipline. See Appendix 8.

To strengthen research expectations from faculty, New York Tech – Vancouver campus offers annual research grants to its faculty. This a new initiative aimed to foster faculty research and creative productivity This scheme replaces the Global Faculty Summer Research Grant introduced in 2011 by the office of the Vice President for Academic Affairs and Provost. [24.]

Professional development awards are also granted to New York Tech-Vancouver faculty through the Travel Funds to Present at a Conference[25].

In addition, faculty can receive partial or full financial support from their respective school to attend one conference annually to present an intellectual contribution and can request additional support for other professional development activities.

As the university infrastructure encourages scholarship as an element of the Mission (research and

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[23] *See https://www.nyit.edu/policies/collection/faculty_handbook_us_campuses#academic_freedom_us_faculty*

[24] *See https://www.nyit.edu/policies/collection/faculty_handbook_global_campuses#*

[25] *Appendix 10: Travel Grants Policy and Procedures*

scholarship that benefit the larger world), and the requirements for faculty continuance and promotion, New York Tech recognizes faculty scholarship, including global faculty scholarship, through its annual Faculty Scholars' Reception, Faculty/Staff Achievements[26], and the New York Tech Magazine.

Finally, the Center for Teaching and Learning (CTL) led by Dr. Francine Glazier (CV in appendices) in New York supports all faculty members at each location in their work as teacher-scholars by cultivating reflective practice and promoting the scholarship of teaching and learning. The center assists faculty members in providing New York Tech students with a career-oriented, forward-looking education that prepares them to succeed in a global economy and an increasingly technological world.

As part of New York Tech's identity as a global institution, particular attention is paid to how social, linguistic, and cultural diversity affect and enrich the student experience. As part of New York Tech's identity as a partially virtual institution, the center serves as a resource for best practices in skillful, appropriate, and effective uses of technology in education. It builds partnerships across campus, recognizing that together faculty can achieve goals they cannot reach individually, and strives to build a fully-engaged community—a community of scholars, a community of learners, a community of professionals working together to give our students the best education possible.

Additional local support is provided by New York Tech-Vancouver Campus's CTL headed by Dr. Gregory Gerber (CV in appendices).

CTL resources and training opportunities for faculty can be accessed online at: https://www.nyit.edu/ctl/resources

7.4 Faculty Scholarly Output / Research Activities

New York Tech hiring and promotion policies and procedures require an annual review of research accomplishments as well as the quality of teaching and service provided to the institution and community. More particularly, faculty members on each global campus are expected to focus on research that supports the economic and social development of the host country and its people. Particular attention must be paid to the quality of research as measured against international standards, as well as to achieving research relevance, to building effective partnerships at home and abroad, and to developing the institution's capacity to meet the needs of society. As research is an essential part of our global faculty's responsibility on each campus, New York Tech as an institution, and New York Tech-Vancouver in particular are taking significant steps to facilitate and promote its faculty's research achievements. Evidence of faculty scholarship at New York Tech-Vancouver includes research projects and grants, papers and publications, and demonstrations of professional competence appropriate to the discipline.[27]

[26] *See https://www.nyit.edu/faculty_staff_accomplishments*

[27] *Appendix 8: Full-time and Adjunct Faculty*

8 Program Resources

8.1 E-Library Resources

New York Tech has a comprehensive online library system, New York Tech E-Library Collections, accessible through the New York Tech E-Library Portal. All members of the New York Tech community have access to a total of 70,209 e-books of which approximately 7% are computer science titles. In addition, there is access to a total of 146,000 e-journals of which 6451 are specifically computer science e-journals [28]. Access to all electronic resources is available 24/7, from any location. All that is needed for off-campus access is a valid New York Tech username and password. In summary, the current New York Tech E-library is sufficient to support the recent growth in the Cybersecurity program.

In addition to the New York Tech e-library portal, students and faculty have access to other physical libraries. New York Tech has an agreement with the British Columbia Institute of Technology (BCIT). One of the areas of collaboration that is specified in the MOU has to do with library resources. An appendix to the collaboration agreement[29] specifies the terms that give New York Tech students and faculty full access to BCIT's Library resources, including access to BCIT's library databases and inter-library loan. New York Tech Vancouver is also situated one block from the Main Vancouver Public Library (VPL).

8.2 Facilities

All facilities are spacious and well-appointed, and each classroom has appropriate equipment and necessary resources[30]. Classrooms have white boards, smart boards, or overhead digital projection equipment. All campus areas provide wireless connectivity. The current IT/AV equipment provision meets the learning needs of the students for the coming three years, with software upgrades being installed as they come onto the market.

All administrative and faculty offices have a computer and Internet access. Software licenses provide access to office productivity applications (word processing, databases, spreadsheets, and presentation). The computer lab is equipped with hardware and software appropriate to the courses offered.

New York Tech has leased an additional 23,000 square feet of space at the Broadway Tech Center campus that will provide additional classrooms, labs, faculty and staff offices, a physical library and quiet study spaces for all students. This additional space is currently being designed to meet the needs of the Vancouver campus and will allow us to give up the West Georgia campus by 2023.

8.3 Information Technology

Program-specific academic software and licenses are provided by New York Tech-NY. New York Tech also uses course management software, anti-plagiarism software, statistical applications, and other broadly useful applications in support of its academic programs.

IT support for New York Tech-Vancouver covers all computer hardware and software, databases, communication networks, computer laboratories, multi-media and audio-visual equipment,

[28] *Appendix 12: Library Report 2020*

[29] *Appendix 13: BCIT-New York Tech Library Agreement.*

[30] *Student desks can be moved to provide whatever seating arrangement may be desired by the faculty to support teaching and learning objectives, including organizing desks to facilitate small group interactions and projects.*

instructional technology, computerized projection facilities, and tele/videoconferencing facilities. The provision of trained technicians and user support services staff is therefore essential. Maintenance and support staff is kept up-to-date with evolving technology by a process of ongoing training. The training programs are run with each update/upgrade of equipment and software. User support is offered through the New York Tech IT support structure whereby faculty or staff experiencing problems with a system or software can call for assistance.[31]

Each annual budget cycle includes provision for the purchase, updating, and upgrading of IT facilities. The New York Tech Vancouver Campus Dean is responsible for liaising between New York Tech-Vancouver and IT support services to ensure that technological advances are incorporated into the planning cycles and operational strategies of New York Tech and that they support the instructional programs.

8.4 Administrative Resources

The College of Engineering and Computer Sciences financial plan includes appropriate human capital support for a program administrator (Assistant Dean). Serving as the Academic Dean's designee, the Assistant Dean in Vancouver leads the program's development. He/she is supported by other faculty members who fulfill administrative assignments in support of the academic program, while simultaneously maintaining their responsibility, as faculty, in the areas of teaching, scholarship, and service.

8.5 Student Affairs Staff

The *Office of Student Affairs* provides a number of services and resources to New York Tech graduate students. The Director of Student Affairs is a student's primary point of contact for academic and career advising. Their job description and that of the Associate Director of Student Affairs and Career Services are provided in Appendix15 and16.

New York Tech Vancouver has established a full-time writing center to support the delivery of the mandatory technical communication class, workshops and drop in services.

The Office of Career Services is available to support New York Tech students by offering an array of programs and services to help enhance their career-oriented professional education, gain access to opportunity, and develop confidence and skills to prepare them for professional success. A career services staff member is available in Vancouver to assist students with career and professional preparation and assist graduates in securing employment. A list of 2019-2020 events is included in Appendix 3.

A Student Engagement Coordinator32 is available in Vancouver to assist students in their learning plans, research, presentation and report writing skills. In that capacity, this staff member develops and delivers workshops/seminars in report writing, academic integrity, research methods (including library skills and citations), and assists students in presentation techniques and public speaking. In addition, this staff member reviews students' academic work and provides feedback with respect to English and report/assignment structure and the use of citations. The academic coordinator works closely with the career and alumni coordinator with respect to student resume writing and interview skills, and assists with other special projects and tasks as assigned.

[31] *Appendix 14: Information Technology Report*
[32] *A job description is available in Appendix 17.*

The Graduate Student Association (GSA) represents New YorkTech's Vancouver students and provides a forum for student voice when dealing with the university's faculty members and administration. Their mission is to Support and advise on student activities, nurture student engagement, and identify and address student concerns.

9 Program Consultation

9.1 Consultations

Both the College of Engineering and Computing Sciences as a whole and the Department of Computer Science have Industry Advisory Boards (IABs) that regularly meet and advise on curricular and other matters of interest to both the School and industry. The Department of Computer Science Industry Advisory Board meets once a year.

In Vancouver, the New York Tech College of Engineering and Computer Sciences academic effort is guided by a local Industry Advisory Board [33] This board, working collaboratively with the local Assistant Dean, provides inputs and feedback concerning localized concerns and advises on academic programs, strengthening and leveraging opportunities, and advancing the school's strategic plan and mission in Vancouver. See also section 1.2.5 Employer Engagement that describes New York Tech-Vancouver's consultation with the local high-tech industry.

New York Tech-Vancouver is an active member of the BC TECH Association. https://wearebctech.com Faculty and staff from New York Tech participate in multiple networking events throughout the year to remain connected with employers in the local high-tech community.

9.2 External Reviews

In developing the Master of Science in Cybersecurity curriculum since 2005, New York Tech faculty made use of both internal assessment data and external referencing via input from (1) College of Engineering Industry Advisory Boards, (2) Stakeholders (faculty, students, alumni and employers) and (3) benchmarking with peer and aspirant institutions.

[33] *Appendix 17: Industry Advisory Board*

10 Program Review and Assessment

10.1 Middle States Accreditation

New York Institute of Technology is accredited by the Middle States Commission on Higher Education (MSCHE). New York Tech continuously self-assesses and formally reports every five years on its compliance with the Middle States' seven standards. New York Tech used the most recent (2019) self-study process as an opportunity to engage the campus community in a collective analysis of the institution's standing with respect to the seven MSCHE standards and 15 requirements of affiliation. The *Self-Study Steering Committee* was guided in its analysis by the following desired outcomes:

- To produce evidence of the degree to which New York Tech meets the MSCHE accreditation standards and requirements of affiliation in the context of its mission;
- To produce a report that brings data, analysis, and discussion of New York Tech's achievements and failures to the fore, and makes them an essential part of the president's focus on creating a climate of trust;
- To offer recommendations for improvement grounded in a clear vision for the institution, evidence-based analysis of strengths and weaknesses, and institution-wide engagement in identifying the steps needed to advance the mission of New York Tech; and
- To leverage the insights gained from the self-study process to optimize strategic planning.
-

Institutionally, the elements of New York Tech 's annual process for assessing student learning outcomes in academic programs are:

- Faculty members create annual assessment plans: they agree on which aspects of their programs will be assessed and how, assign responsibilities, and establish timelines
- In addition to program-specific outcomes, assessment plans for undergraduate programs also include assessment of a core learning outcome designated by the Assessment Committee to be examined across the university. This is intended to stimulate conversations about improving general education outcomes among the full range of departments and schools
- Assessment plans for the year are submitted to the committee, which reviews and discusses them and provides feedback to the dean and program faculty
- The plan is implemented: data are collected and analyzed and an improvement action plan is developed
- Assessment reports for the year, summarizing the assessment activities, analyses, and improvement plans are submitted to the committee, which reviews these documents and provides feedback, and
- The Assessment Committee prepares a formal report on assessment across the university.

All results and action plans for both the individual Schools and Colleges and the NYIT institution as a whole[34], are collected by the Assessment Committee and posted publicly. Specifically, all

[34] *Available at https://www.nyit.edu/planning/academic_assessment_plans_reports*

assessments for the College of Engineering and Computing Sciences can also be found online[35]. The College of Engineering and Computing Sciences' evaluation processes are comprehensive and systematic. The evaluations consider:

- Quality of instruction, including annual faculty reviews, review of faculty qualifications and efficiencies.
- Periodic program review, including program, curriculum and course development. Like other programs in the College, the MSDS program will have a rigorous and multidimensional assessment protocol in place to assure that graduates have achieved the intended program learning outcomes and, by implication, the program objectives. The program outcomes state that upon completion of the program, students will be able to:
    - Apply data science concepts and methods to solve unique and complex problems in business and scientific contexts and communicate these solutions effectively to varied audiences
    - Apply computing theory, languages and algorithms, and mathematical and statistical models, including the principles of optimization to formulate and use data analyses
    - Apply ethical practices in everyday technical and business activities, and make ethical decisions with respect to design and use of data management tools.

Program and course evaluation are a dynamic process that provides systematic, consistent, and relevant data for continuous program improvement. The assessment process has both course-embedded and constituency-based assessment tools. Course-embedded assessment data are the primary tool used to assess the achievement of course learning outcomes and program outcomes. Constituency-based assessment data are secondary sources in the program outcome assessment process but represent essential components to the assessment of program objectives.

Constituency-based assessment tools and data are:

- Industrial Advisory Board meeting minutes
- Institutional surveys
- Student Exit interviews
- Continuous Program Improvement (CPI)[36]. See Appendix 19. The CPI process[37] is used to establish ongoing unit level metrics and foster a culture of continuous improvement in which all faculty and staff are encouraged to analyze their work processes and suggest improvements for the betterment of the institution.

10.2 Continuous Program Improvement

New York Tech implemented Continuous Program Improvement (CPI) in 2020 across all academic department and students support units to improve educational effectiveness. CPI emphasizes data-informed decision-making process to guide departments for overall quality improvement that leads to the improvement of students learning, student's college experiences and achievement.

[35] *See https://www.nyit.edu/planning/plans_reports_soecs*

[36] *See https://www.nyit.edu/planning/continuous_program_improvement*

[37] *For templates, committee notes, vision, processes and other resources, see https://www.nyit.edu/planning/continuous_program_improvement*

CPI Committee:

The CPI Committee of New York Tech's Academic Senate is the institutional unit that brings together all assessment and improvement activities at the university—for programs with or without professional accreditation, and for academic departments and student support units. The offices of Research, Assessment, and Decision Support and the Office of Institutional Effectiveness provide institutional support. The committee members come from all academic schools and numerous support departments. Its meetings are open and minutes are posted on the intranet site of the Academic Senate.

The committee's mission is to:

- Raise the visibility of CPI for educational effectiveness assessment within New York Tech
- Maintain a common, unified, mission-driven process
- Improve educational effectiveness by increasing faculty participation in and knowledge of science of improvement
- Ensure that the Continuous Program Improvement (CPI) process is used to advance New York Tech's mission and goals and connected CPI with financial planning and support
- The CPI process and policies are meeting Educational Effectiveness Assessment (MSCHE, Standard V)
- Periodically evaluate (CPI) process and make recommendations for improvements

CPI Process and Policy:

1. Departments set up goals according to its mission and functions that align with New York Tech's missions and goals.
2. Select appropriate key performance indicators (KPIs) for each of the goals that can accurately measure the performance, motivate and direct actions, and identify opportunities for improvement.
3. Hold an annual departmental review and planning meeting, and focus departmental energy and effort on a couple of goals and KPIs each year to make the CPI a sustained and manageable process. The major KPI areas include:
    - Student learning outcomes (curriculum, course and program level learning outcomes update)
    - Student success (admission criteria review, retention, DFW, graduation rate, license passing rate…)
    - Student engagement and satisfaction (NL_SSI, NSSE, or departmental survey)
    - Faculty performance (teaching evaluation, scholarship, services)
    - Cost efficiency (classroom utilization, equipment and technology sufficiency...)
    - Departmental policies and procedures (review and update)
    - Self-defined others.
4. The institution rewards improvement with recognition and resources for quality initiatives (QI).

The Quality Initiative with Resource Support

When weakness is identified in the CPI process, and improvement needs external resources, the department submit Quality Initiative Proposal, and CPI committee review the proposal with objective Criteria, and cast votes to decide its eligibility. Founded QI is required to submit annual update about meeting its expected outcomes.

More detailed information about the CPI program can be found at:
https://www.nyit.edu/planning/continuous_program_improvement

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