The Master of Science in Cybersecurity Analytics and Operations program is designed to create a deep understanding of cybersecurity analytics and operations, by blending education relating to technology, incident response, strategic planning, and crisis management. The program also aims to prepare the next generation of cybersecurity analysts to better protect digital information from attack through cyberdefense strategies, including incident response, strategic planning, and crisis management. With a foundation in mathematics and computer programming, students will be prepared to recognize, analyze, defend against, and manage risks related to a wide range of threats to online information, data stores, and networks. The program will be delivered in a resident format that takes one to two years. The total credits of the program is 30. A one-year program starts in a Fall semester, and concludes at the end of the following Summer.

The Master of Professional Studies in Cybersecurity Analytics and Operations (MPSCY) is an innovative program that targets professionals and organizational leaders who seek a professional education and training program. The purpose of the professional master's program is to produce professionals and organizational leaders who not only can select and draw upon the necessary foundations within the cybersecurity analytics and operations technology areas, test the applicability of these foundations for addressing a given issue, and apply the resulting solutions, but also can be aware of the multitude of technological trends and environmental factors that organizations must address in the changing global economy. The M.P.S. equips students to: understand and analyze the profound information and technological changes sweeping the world; meet challenges by developing innovative solutions using the foundations of cybersecurity analytics and operations; and have a clear advantage in today's highly competitive and dynamic environment by continuously learning new trends, issues, and innovations.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (http://gradschool.psu.edu/graduate-education-policies/).

Master of Professional Studies (M.P.S.)

Applicants to the M.P.S. program are required to submit three letters of reference, a current resume (including present position and any publications), 1 to 3 page statement of goals related to pursuing an advanced degree and career in IST and provide a sample of the applicant's writing (e.g. technical paper, etc.).

Because cybersecurity analytics and operations career opportunities exist in many disciplines, students with a wide range of disciplinary backgrounds may be accepted into the program. A bachelor's degree in a related area (e.g., engineering and science), while not necessary for admission, is helpful in the successful completion of the degree. It is expected that students will have a basic level of competency in mathematics and programming.

Entrance Requirement regarding Mathematics: Applicants must complete a Calculus course equivalent to Penn State University's MATH 110 or MATH 140.

Entrance Requirement regarding Programming: Applicants must complete two introductory-level programming courses where both courses used the same language. If an applicant believes his/her work experience satisfies the background, he/she should include a recommendation letter from a technical colleague describing the applicant's coding contributions at work. In addition, students who meet all other academic requirements, but need to improve identified gaps in specific programming skills areas, will have access to educational bridge materials to help improve certain knowledge domains.

It is expected that the successful applicant will have an overall grade point average of 3.00 (on a 4.00 scale) or higher for his or her undergraduate study and/or graduate-level study. However, accomplishments demonstrated through work experience and recommendation letters from the applicant's academic adviser or employer will also play an important role in making the admission decision. The most qualified applicants will be accepted into the program until all spaces for new students are filled.

Master of Science (M.S.)

Applicants to the M.S. program are required to submit three letters of reference, a current resume (including present position and any publications), 1 to 3 page statement of goals related to pursuing an advanced degree and career in IST and provide a sample of the applicant's writing (e.g. technical paper, etc.).

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**Degree Requirements**

**Master of Professional Studies (M.P.S.)**

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (http://gradschool.psu.edu/graduate-education-policies/).

The M.P.S. program requires a minimum of 33 credits, 24 of which must be earned at Penn State. A maximum of 9 transfer credits of high-quality graduate work may be applied toward the requirements for the degree, subject to restrictions outlined in GCAC-309 Transfer Credit (http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-309-transfer-credit/). At least 18 credits must be courses at the 500 or 800 level, with at least 6 credits at the 500 level.

The 33 credits are distributed among the following requirements. A student first takes 21 credits of core courses. The student then takes 9 credits of electives. Lastly, the student must complete a master's project guided by the student's adviser and completed while enrolled in IST 594.

**Elective Courses**

The elective courses for the M.P.S. will be selected from a list maintained by the program office.

**Master's Project**

The project requires all students in the M.P.S. to focus on a well-defined issue or problem relevant to the information sciences and technology. The student will submit a project proposal to his/her faculty adviser for approval. Upon completion of the project, the student will share or present the project results at a final presentation as a component of IST 594.

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<tr>
<th>Code</th>
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<tbody>
<tr>
<td>IST 543</td>
<td>Foundations of Software Security</td>
<td>3</td>
</tr>
<tr>
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<td>Network Management and Security</td>
<td>3</td>
</tr>
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<td>3</td>
</tr>
<tr>
<td>IST 820</td>
<td>Cybersecurity Analytics</td>
<td>3</td>
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Choose 9-12 Credits from the following:

- IST 451 Network Security
- IST 454 Computer and Cyber Forensics
- IST 456 Information Security Management
- IST 504 Foundations of Theories and Methods of Information Sciences and Technology Research
- IST 511 Information Management: Information and Technology
- IST 555 Intelligent Agents and Distributed Decision Making
- IST 557 Data Mining: Techniques and Applications
- IST 558 Data Mining II
- IST 564 Crisis, Disaster and Risk Management
- IST 816 Web Fundamentals
- IST 841 Search Engines & Information Retrieval
- IST 868 Topics in Visual Analytics for Security Intelligence

**Electives**

Select 9 credits of electives from a list of approved electives available from the program office.

**Culminating Experience**

IST 594 Research Topics (Master's Project) 3

Total Credits 33

**Master of Science (M.S.)**

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (http://gradschool.psu.edu/graduate-education-policies/)

The M.S. in Cybersecurity Analytics and Operations requires a minimum of 30 credits at the 400, 500, 600, or 800 level, with at least 18 credits in the 500 or 600 series combined; 27 of the 30 credits must be earned at Penn State. Students will be able to complete the proposed Master's program in one calendar year (including summer) or two academic years. All of the courses listed below are three credit hour courses, unless otherwise noted. Students pursuing the one-year format must complete the non-thesis track (IST 594). In addition, the one-year M.S. track must adhere to the following conditions:

- Students must take at least one credit of research (IST 594) for each of the three semesters (Fall, Spring, and Summer).
- A research adviser must be assigned to students in their first semester, as selection and discussion of the student's research topic must begin as soon as possible.
- Students who need more time to complete the final paper must be allowed to complete the paper, and have it reviewed and approved after the third semester (Summer) has ended. Students are not required to remain in residence while they complete the final paper. However, extensions granted to students in this program must comply with the Graduate Council policy on deferred grades (https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-400/gcac-401-grading-system/).

These 30 credits are distributed among the following requirements:

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Choose 9-12 Credits from the following:

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- IST 558 Data Mining II
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- IST 816 Web Fundamentals
- IST 841 Search Engines & Information Retrieval
- IST 868 Topics in Visual Analytics for Security Intelligence

**Electives**

Select 9-12 Credits from the following:

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- IST 454 Computer and Cyber Forensics
- IST 456 Information Security Management
- IST 504 Foundations of Theories and Methods of Information Sciences and Technology Research
- IST 511 Information Management: Information and Technology
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- IST 557 Data Mining: Techniques and Applications
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- IST 564 Crisis, Disaster and Risk Management
- IST 816 Web Fundamentals
- IST 841 Search Engines & Information Retrieval
- IST 868 Topics in Visual Analytics for Security Intelligence

**Culminating Experience**

IST 594 Research Topics (Scholarly Paper) 3-6

IST 600 Thesis Research 6

Total Credits 30

Students can choose to complete a thesis or a scholarly paper as the culminating experience for the degree. Students who choose to complete a thesis must complete at least 6 credits in thesis research (IST 600 or IST 610). The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense. Students in the non-thesis track must write a satisfactory scholarly paper while enrolled in IST 594 and complete at least 18 credits at the 500 level.
Student Aid

Refer to the Tuition & Funding (http://gradschool.psu.edu/graduate-funding/) section of The Graduate School’s website. Students in this program are not eligible for graduate assistantships.

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (http://www.worldcampus.psu.edu/tuition-and-financial-aid/) of the World Campus website for more information.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Information Sciences and Technology (IST) Course List (https://bulletins.psu.edu/university-course-descriptions/graduate/ist/

Learning Outcomes

Master of Professional Studies (M.P.S.)

1. [KNOW] Recognize, understand, identify and assess potential threats, vulnerabilities, and consequences in a context from local to global environments.
2. [APPLY/CREATE] Integrate the use of disciplinary methods, techniques, and knowledge to solve practical, real-world problems.
3. [COMMUNICATE] Present scientific evidence and best practice to inform and improve practical, real-world decisions.
4. [THINK] Search, evaluate, and synthesize literature to integrate cybersecurity principles into disciplines and professional fields.
5. [PROFESSIONAL PRACTICE] Make use of ethical standards and principles of integrity as a foundation in decision-making.

Master of Science (M.S.)

1. [KNOW] Demonstrate appropriate breadth and depth of interdisciplinary knowledge and comprehension of the major issues in cybersecurity analytics and operations.
2. [APPLY/CREATE] Use interdisciplinary knowledge and methods of cybersecurity analytics and operations to plan and conduct a research thesis or scholarly paper.
3. [COMMUNICATE] Communicate the major issues of cybersecurity analytics and operations effectively.
4. [THINK] Demonstrate analytical and critical thinking within cybersecurity analytics and operations, including across discipline.
5. [PROFESSIONAL PRACTICE] Know and conduct themselves in accordance with the highest ethical standards, values, and, where these are defined, the best practices of cybersecurity analytics and operations (as expressed in SARI training modules).