CYBERSECURITY ANALYTICS AND OPERATIONS, B.S. (ALTOONA)

Begin Campus: Any Penn State Campus
End Campus: Altoona

Program Description
The Bachelor of Science in Cybersecurity Analytics and Operations in the College of Information Sciences and Technology (IST) is an interdisciplinary program that prepares students for careers as cybersecurity professionals. It educates students on the essential concepts of cyber-defense and the analytical fundamentals of cybersecurity, with a focus on the analytical and risk management underpinnings and associated cyber-defense techniques and strategies for ensuring the safety of online information stored in large and heterogeneous networks that are embedded within and across the complex socio-technical infrastructures that are pervasive in today’s business, government and military organizations. Students will acquire the knowledge and skills needed to critically assess and respond to modern information security threats, using approaches that are grounded in a holistic understanding of adversarial strategies and effective responses. More specifically, it will offer an in-depth and domain-independent approach to the development of skills in cyberdefense technologies, tools and processes; cybersecurity analytics and visualization; and cybersecurity risk analysis and management. The major draws from concepts and skills associated with a number of disciplines, including information science, management science, statistics and data science, human behavior, and law/policy. Graduates will be prepared to join the rapidly growing cybersecurity workforce deployed across organizations of diverse sizes and missions.

What is Cybersecurity Analytics and Operations?
Cybersecurity is a field that deals with the protection of computer systems, networks, programs, and data from attacks and unauthorized access. This includes the development of cyber defense tools to protect critical infrastructure as well as the analysis and mitigation of cyber threats.

Cybersecurity is a very broad field. This program focuses students beyond the information technology field and instead focuses on the analysis of cybersecurity data, identification of cyber incidents, understanding the actions of malware, communication of concerns to business stakeholders and the general public. High performing cyber analysts have a strong mathematical and computational background. They often employ computer programming and scripting to solve problems and integrate existing tools. They analyze the data they are presented with from intrusion detection sensors, firewalls, and anti-malware tools.

Cybersecurity professionals apply their skills for organizations to prevent cyber criminals, hacktivists, and persistent nation-state actors. They protect organizations, companies, healthcare institutions, and government agencies from the loss of confidential data. They keep abreast of new developments technically, as well as those in the work domain of the organization and events that occur in the world at large.

MORE INFORMATION ABOUT CYBERSECURITY ANALYTICS AND OPERATIONS (https://ist.psu.edu/prospective/undergraduate/academics/cybersecurity/)

You Might Like This Program If...
- You enjoy working with and on computers as well as their operating systems and applications.
- You have an interest in business and organizations and securing networks from threats.
- You want to protect digital information, data stores, and computer networks from threats.
- You want to learn the cyber defense strategies used to anticipate, recognize, and defend against computer attacks.
- You’re passionate about how we can keep sensitive information out of the hands of hackers, cybercriminals, and terrorist organizations.
- You enjoy working on a team to solve technical problems for organizations.
- You are interested in computer programming and mathematics.

MORE INFORMATION ABOUT WHY STUDENTS CHOOSE TO STUDY CYBERSECURITY ANALYTICS AND OPERATIONS (https://ist.psu.edu/prospective/undergraduate/academics/cybersecurity/)

Entrance to Major
To be eligible for the Cybersecurity Analytics and Operations major, students must:

1. Have completed the following entrance-to-major requirements with a grade of C or better in each: CYBER 100 or CYBER 100S, IST 210, IST 220, IST 242 or CMPSC 122 or CMPSC 132, and STAT 200 or SCM 200.
2. Have achieved a minimum cumulative grade point average of 2.00 prior to and through the end of the semester during which the entrance to major is requested.

Degree Requirements
For the B.S. degree in Cybersecurity Analytics and Operations, a minimum of 123 credits is required:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Electives</td>
<td>3</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>87</td>
</tr>
</tbody>
</table>

12 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 6 credits of GQ courses, 3 credits of GS courses, 3 credits of GWS courses.

Requirements for the Major
To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/82-44).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescribed Courses: Require a grade of C or better</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

**Foundations (grade of C or better is required and Inter-Domain courses do not meet this requirement.)**

- Quantification (GQ): 6 credits
- Writing and Speaking (GWS): 9 credits

**Breadth in the Knowledge Domains (Inter-Domain courses do not meet this requirement.)**

- Arts (GA): 3 credits
- Health and Wellness (GHW): 3 credits
- Humanities (GH): 3 credits
- Social and Behavioral Sciences (GS): 3 credits
- Natural Sciences (GN): 3 credits

**Integrative Studies**

- Inter-Domain Courses (Inter-Domain): 6 credits

**Exploration**

- Inter-Domain Courses (Inter-Domain): 6 credits
- GN, may be completed with Inter-Domain courses: 3 credits
- Interpretations (GA): 3 credits
- International Cultures: 3 credits
- United States Cultures: 3 credits

**University Degree Requirements**

**First Year Engagement**

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

**Cultures Requirement**

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

**Writing Across the Curriculum**

3 credits required from the college of graduation and likely prescribed as part of major requirements.

**Total Minimum Credits**

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits.
Students should consult with their college or department adviser for information on specific credit requirements.

**Quality of Work**
Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

**Limitations on Source and Time for Credit Acquisition**
The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 ([https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80](https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80))). For more information, check the Suggested Academic Plan for your intended program.

**Program Learning Objectives**

- **Knowledge/Application:** Understand and apply the interdisciplinary knowledge of information sciences in a security context to recognize, analyze, defend against, and manage cyber risks.
  - Understand the components and interoperability of computer hardware, operating systems, networks and databases.
  - Demonstrate proficiency in programming and scripting to perform Cybersecurity automation and analysis.
  - Understand Cyber threats and appropriate defensive designs and tools to mitigate the risk of attack.
  - Understand the procedures for Cybersecurity Incident Handling and Response.
  - Understand the static and dynamic analysis of malware.

- **Problem-Solving:** Understand, apply and adapt various problem solving strategies, using appropriate technology and methods.
  - Identify Cybersecurity threats and implement complementary defensive measures to mitigate risk.
  - Apply data analytics in a security context to analyze, predict and prevent cyberattacks.
  - Perform malware analysis and forensics to understand the nature and origin of attacks.
  - Evaluate several Cybersecurity frameworks and provide analysis that culminates in a high level executive briefing exercise.

- **Evaluation and Communication (Individual and Team):** Communicate and work effectively (both individually and in teams) with a range of perspectives and audiences through a variety of media.
  - Synthesize data from multiple sources to help make informed decisions.
  - Communicate effectively to a variety of audiences through writing and the spoken word.

- **Professional Responsibilities:** Understand professional responsibilities in terms of the ethical, legal and security policy aspects of information assurance and security.
  - Understand the rules, regulations and issues related to compliance with applicable laws and regulations related to Information Security and Privacy.
  - Understand the legal and ethical ramifications of violating the trust that organizations will place in you as a Cybersecurity professional.

- **Lifelong Learning:** Commit to the continuous acquisition of relevant knowledge for professional development by self-teaching and/or ongoing education and certification.
  - Employ information-seeking strategies and self-directed learning in pursuit of current knowledge.
  - Enroll in professional development and pursue industry certifications to enhance your career and the profession.

**Academic Advising**
The objectives of the university’s academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee’s unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY ([https://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy/](https://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy/))

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Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2024-25 academic year. To access previous years' suggested academic plans, please visit the archive (https://bulletins.psu.edu/undergraduate/archive/) to view the appropriate Undergraduate Bulletin edition.

Cybersecurity Analytics and Operations, B.S. at Altoona Campus

The course series listed below provides only one of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an Academic Requirements or What If report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

<table>
<thead>
<tr>
<th>First Year</th>
<th>Credits</th>
<th>Spring Credits</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IST 140*#1</td>
<td>3</td>
<td>IST 210*#1</td>
<td>3</td>
</tr>
<tr>
<td>CYBER 100 (FYS)*#1</td>
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<td>IST 220*#1</td>
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<td>MATH 110 (GQ)*</td>
<td>4</td>
<td>SRA 111 (GS)*†1</td>
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</tr>
<tr>
<td>CAS 100 (GWS)*‡</td>
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<td>ENGL 15 or 30H (GWS)*‡</td>
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<td>PSU 3</td>
<td>1 Application Focus</td>
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<tr>
<td>General Education (GN, GA, GH, GS, or GHW)</td>
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<tr>
<td></td>
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<tbody>
<tr>
<td>IST 242*#1</td>
<td>3</td>
<td>IST 261*</td>
<td>3</td>
</tr>
<tr>
<td>STAT 200 (GQ)<em>#</em></td>
<td>4</td>
<td>SRA 211*</td>
<td>3</td>
</tr>
<tr>
<td>CYBER 262*</td>
<td>3</td>
<td>IST 230*</td>
<td>3</td>
</tr>
<tr>
<td>SRA 221*</td>
<td>3</td>
<td>SRA 231*</td>
<td>3</td>
</tr>
<tr>
<td>Application Focus</td>
<td>3 General Education (GN, GA, GH, GS, or GHW)</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>16</td>
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<thead>
<tr>
<th>Third Year</th>
<th>Credits</th>
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<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CYBER 362*</td>
<td>3</td>
<td>CYBER 342W*</td>
<td>3</td>
</tr>
<tr>
<td>IST 451*</td>
<td>3</td>
<td>IST 454*</td>
<td>3</td>
</tr>
<tr>
<td>SRA 365*</td>
<td>3</td>
<td>SRA 311W*</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 202C or 202D (GWS)*‡</td>
<td>3</td>
<td>CYBER 366*</td>
<td>3</td>
</tr>
<tr>
<td>General Education (GN, GA, GH, GS, or GHW)</td>
<td>3 Application Focus</td>
<td>3</td>
<td></td>
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<tr>
<td>General Education (GHW)</td>
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<td></td>
<td>16.5</td>
<td>15</td>
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<tr>
<th>Fourth Year</th>
<th>Credits</th>
<th>Spring Credits</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IST 432*</td>
<td>3</td>
<td>CYBER 440*</td>
<td>3</td>
</tr>
<tr>
<td>IST 456*</td>
<td>3</td>
<td>Application Focus 400 Level</td>
<td>3</td>
</tr>
<tr>
<td>SRA 472*</td>
<td>3</td>
<td>General Education (GN, GA, GH, GS, or GHW)</td>
<td>3</td>
</tr>
<tr>
<td>General Education (GN, GA, GH, GS, or GHW)</td>
<td>3 Elective</td>
<td>3</td>
<td></td>
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<tr>
<td></td>
<td>16.5</td>
<td>15</td>
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</tr>
</tbody>
</table>
Cybersecurity careers in government or related consulting sectors.

The Geopolitics focus is for students who have an interest in pursuing modeling cyberthreats from nation-states and other threat actors. Understanding the geopolitical landscape is key to understanding and

### Application Development

Application focus area list to select a course that meets a General Education requirement (GS/GHW) and serves as a prerequisite for more advanced coursework within the application focus. This course does not count as part of the 9 credits of application focus.

#### Advising Notes:

1 credit of IST 495 Internship is also required.

Students pick one of the five tracks below or create a custom 3-course application focus. Students must pick three (3) credits at the 400 level. All nine (9) credits must be in the same application focus area. It is recommended that students use the application focus area list to select a course that meets a General Education requirement (GS/GHW) and serves as a prerequisite for more advanced coursework within the application focus. This course does not count as part of the 9 credits of application focus sequence.

#### Geopolitics

Understanding the geopolitical landscape is key to understanding and modeling cyberthreats from nation-states and other threat actors. The Geopolitics focus is for students who have an interest in pursuing cybersecurity careers in government or related consulting sectors.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IST 311</td>
<td>Object-Oriented Design and Software Applications</td>
<td>3</td>
</tr>
<tr>
<td>IST 331</td>
<td>Foundations of Human-Centered Design</td>
<td>3</td>
</tr>
<tr>
<td>IST 361</td>
<td>Application Development Design Studio II</td>
<td>3</td>
</tr>
<tr>
<td>IST 402</td>
<td>Emerging Issues and Technologies</td>
<td>3</td>
</tr>
<tr>
<td>IST 411</td>
<td>Distributed-Object Computing</td>
<td>3</td>
</tr>
<tr>
<td>IST 412</td>
<td>The Engineering of Complex Software Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

### Law and Policy

Cybersecurity careers in law enforcement require knowledge of laws and policies focused on the handling of evidence related to digital forensics and monitoring. Individuals in the private sector and government agencies must also understand and adhere to these topics as they involve cybersecurity. The Law and Policy focus is for students who want to understand law and policy as they relate to digital data.

#### Advising Notes:

* Course requires a grade of C or better for the major
† Course requires a grade of C or better for General Education
# Course is an Entrance to Major requirement
† Course satisfies General Education and degree requirement

1 IST/SRA/CYBER course offered both fall and spring semesters at Altoona. Otherwise, IST/SRA/CYBER courses are only offered once per academic year.

#### University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy Cultural Diversity Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARMY, AIR, NAVSC (any)</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>AFR/PLSC 440</td>
<td>Globalization and Its Implications</td>
<td>3</td>
</tr>
<tr>
<td>CAS 404</td>
<td>Conflict Resolution and Negotiation</td>
<td>3</td>
</tr>
<tr>
<td>COMM 458</td>
<td>Media Law and Ethics</td>
<td>3</td>
</tr>
<tr>
<td>GEOG 260</td>
<td>Geographic Information in a Changing World: Introduction to GIScience</td>
<td>3</td>
</tr>
<tr>
<td>GEOG 333</td>
<td>Human Dimensions of Natural Hazards</td>
<td>3</td>
</tr>
<tr>
<td>GEOG 363</td>
<td>Geographic Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>IB 440</td>
<td>Globalization and Its Implications</td>
<td>3</td>
</tr>
<tr>
<td>IST 301</td>
<td>Information and Organizations</td>
<td>3</td>
</tr>
<tr>
<td>PLSC 291</td>
<td>Introduction to Peace and Conflict Studies</td>
<td>3</td>
</tr>
<tr>
<td>PLSC 461</td>
<td>Politics of the European Union</td>
<td>3</td>
</tr>
<tr>
<td>PLSC 467</td>
<td>International Relations of the Middle East</td>
<td>3</td>
</tr>
<tr>
<td>PLSC 481</td>
<td>Global Political Economy</td>
<td>3</td>
</tr>
<tr>
<td>PLSC 491</td>
<td>Peace and Conflict Studies Seminar</td>
<td>3</td>
</tr>
<tr>
<td>SRA 421</td>
<td>The Intelligence Environment</td>
<td>3</td>
</tr>
<tr>
<td>SRA 433</td>
<td>Deception and Counterdeception</td>
<td>3</td>
</tr>
<tr>
<td>SRA 450</td>
<td>Cyber-Crime and Cyber-Warfare</td>
<td>3</td>
</tr>
<tr>
<td>SRA 471</td>
<td>Informatics, Risk, and the Post-Modern World</td>
<td>3</td>
</tr>
<tr>
<td>SRA 480</td>
<td>Crisis Informatics</td>
<td>3</td>
</tr>
</tbody>
</table>
Economics
The Economics focus is for students who have an interest in pursuing cybersecurity careers in the financial services sector or government. Designed to help students understand today's financial and economic environments, this focus highlights the importance of translating the financial and economic impact of cybersecurity activities to effectively manage any program.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLAW 243</td>
<td>Legal Environment of Business</td>
<td>3</td>
</tr>
<tr>
<td>BA 301</td>
<td>Finance</td>
<td>3</td>
</tr>
<tr>
<td>ECON 302</td>
<td>Intermediate Microeconomic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECON 399</td>
<td>Foreign Studies</td>
<td>1-12</td>
</tr>
<tr>
<td>ECON 402</td>
<td>Decision Making and Strategy in Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 409</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ECON 438</td>
<td>Winners and Losers from Globalization</td>
<td>3</td>
</tr>
<tr>
<td>ECON 445</td>
<td>Health Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 447</td>
<td>Economics of Sports</td>
<td>3</td>
</tr>
<tr>
<td>ECON 470</td>
<td>International Trade and Finance</td>
<td>3</td>
</tr>
<tr>
<td>ECON 479</td>
<td>Economics of Matching</td>
<td>3</td>
</tr>
<tr>
<td>FIN 301</td>
<td>Corporation Finance</td>
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<tr>
<td>HPA 445</td>
<td>Health Economics</td>
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</tr>
<tr>
<td>HPA 332</td>
<td>Health Systems Management</td>
<td>3</td>
</tr>
<tr>
<td>HPA/BBH 440</td>
<td>Principles of Epidemiology</td>
<td>3</td>
</tr>
<tr>
<td>HPA 445</td>
<td>Health Economics</td>
<td>3</td>
</tr>
<tr>
<td>HPA 450</td>
<td>Healthcare Policies and Politics</td>
<td>3</td>
</tr>
<tr>
<td>HPA 470</td>
<td>Health Care Information Management</td>
<td>3</td>
</tr>
<tr>
<td>IST 402</td>
<td>Emerging Issues and Technologies</td>
<td>3</td>
</tr>
<tr>
<td>NURS 357</td>
<td>Introduction to Nursing Informatics</td>
<td>3</td>
</tr>
<tr>
<td>NURS 458</td>
<td>Ethical Challenges in Healthcare Informatics</td>
<td>3</td>
</tr>
</tbody>
</table>

Custom Application Focus
There is an option for a student to create a custom 3-course application focus sequence. It must be a coherent sequence of courses that provides context for the student in terms of cybersecurity content. It must contain three (3) credits of 400-level coursework. The focus area courses must be selected in consultation with a teaching CYBER faculty member and an academic adviser.

Career Paths
Cybersecurity blends the technical expertise needed to analyze security issues and create cyberdefense strategies with the interpersonal skills needed to communicate threats to a variety of audiences. The program prepares students to meet the growing need for professionals who can defend against threats to digital information and assets. IST’s Office of Career Solutions helps students navigate their internship and career development in the field through coaching, workshops, interview preparation, resume reviews, career fairs, job postings, and networking opportunities.

Careers
Because our courses blend technical knowledge with skills in communication and business, a Cybersecurity Analytics and Operations degree allows students to pursue opportunities as cybersecurity analysts, cyberthreat advisers, penetration testers, and a number of other unique careers in fields such as defense, government, and business.

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