This module provides the students with a practical exercise applying their programming skills to solve anomaly detection problems. The third cyber-defense skill is on using the Metasploit tool to do penetration testing. This module provides the students with a practical exercise applying their programming skills to do penetration testing. The fourth cyber-defense skill is on implementing a network intrusion detection software tool which can detect suspicious network flows. This module provides the students with a practical exercise applying their programming skills to solve signature-based intrusion detection problems.
Malware analysis and analytics. Through this course, the students will learn hands-on laboratory activities to help students obtain practical experience in malware classification and clustering. The course relies extensively on hands-on how to use analytic approaches such as automatic malware trace classification and defenses. It then builds on this foundation by teaching the students how to address malware issues using analysis techniques and methods, and defenses. The course begins by introducing the foundations of malware, including history, vulnerability, types, analysis methods, and defenses. It then builds on this foundation by teaching students how to address malware issues using analysis techniques such as reverse engineering and static program analysis, as well as how to use analytic approaches such as automatic malware trace classification and clustering. The course relies extensively on hands-on laboratory activities to help students obtain practical experience in malware analysis and analytics. Through this course, the students will gain concrete understandings on principles and practices of malware analysis and defense.

**Enforced Prerequisite at Enrollment:** CYBER 262 and SRA 221 and SRA 231

**Enforced Prerequisite at Enrollment:** CYBER 342W and (ENGL 202A or ENGL 202B or ENGL 202C or ENGL 202D) and 7th semester standing.

**Enforced Prerequisite at Enrollment:** IST 242 and IST 261 and CYBER 262

**Enforced Prerequisite at Enrollment:** CYBER 399: Foreign Studies

**Enforced Prerequisite at Enrollment:** CYBER 440: Cybersecurity Capstone

Cyberattacks involve advanced and sophisticated techniques to infiltrate corporate computers, networks and enterprise systems and critical infrastructures. Types of attacks include advanced malware, zero day attacks and advanced persistent threats. Advance warning about attackers and intelligence about the threat landscape is considered by many security leaders to be essential features in cyber-defense. The massive increase in the rate of novel cyberattacks has made data-mining-based analytics techniques a critical component in detecting security threats. Big data analytics in security involves the ability to gather massive amounts of digital information to analyze, visualize and draw insights that can make it possible to predict and stop cyberattacks. This studio course teaches fundamental data-driven cybersecurity analytics skills using programming skills acquired in earlier courses. The course will be divided into three modules. The first module prepares students for security analytics, by refreshing or making them familiar with two popular data analytics programming languages (e.g., R and Python). The second module focuses on understanding the key cybersecurity analytics process including data exploration, data visualization and data preparation and examining popular data mining algorithms such as linear and logistic regression, decision trees, support vector machine, and neural networks and similar techniques for security analytics. In the third module, students use analytics process and methods for selected cybersecurity problems, such as security breaches, ZeroAccess Infection, Log Analytics, Access Analytics and Web Hacking Analytics. Through this studio course, the students will gain concrete understanding of security analytics processes, methodologies and how to apply these concepts and tools to real-world cybersecurity. A major component of the course will be several hands-on exercises and a final team-based project. Hands-on exercises provide students with knowledge, skills and hands-on experience of learning security analytics process and methodologies to address security problems. The team-based project allows students to apply what they have learned to address real world security threat. This course will incorporate collaborative and action-learning experiences wherever appropriate. Emphasis will be placed on developing and practicing writing and speaking skills through application of the concepts, theories and technologies that define the course.

**Enforced Prerequisite at Enrollment:** CYBER 262 and SRA 221 and SRA 231

**Courses offered in foreign countries by individual or group instruction.**

**International Cultures (IL)**

**CYBER 362: Cybersecurity Analytics Studio**

3 Credits

Cybersecurity Capstone is an advanced, culminating course for students who are majoring in Cybersecurity. This course provides the student with a practical exercise, designed by the instructor. The initial weeks of the semester provide the student with an overview of several analytic frameworks that are used in cybersecurity shops and organizations. Then, the student reviews specific technical analysis methods in malware, static and dynamic analysis, file system exploration, security log file analysis and network analysis. The findings from these analyses are then integrated into the analytic framework, gaps are identified, further analysis is conducted to fill the gaps. In the final weeks of the semester, students construct a high level briefing that supplies appropriate levels of technical detail to top level executives.

**Enforced Prerequisite at Enrollment:** CYBER 342W and (ENGL 202A or ENGL 202B or ENGL 202C or ENGL 202D) and 7th semester standing.

**CYBER 494: Research Project**

1-12 Credits/Maximum of 12

Supervised student activities on research projects identified on an individual or small-group basis.

**CYBER 496: Independent Studies**

1-18 Credits/Maximum of 18

Creative projects, including research and design, that are supervised on an individual basis and that fall outside the scope of formal courses.

**CYBER 497: Special Topics**

1-9 Credits/Maximum of 9

Formal courses offered infrequently to explore, in depth, a comparatively narrow subject which may be topical or of special interest.

**CYBER 499: Foreign Studies**

1-12 Credits/Maximum of 12

Courses offered in foreign countries by individual or group instruction.

**International Cultures (IL)**

**CYBER 366: Malware Analytics**

3 Credits

Malware Analytics is an intermediate course required for students who are majoring in Cybersecurity Analytics and Operations. It is a three-credit hands-on course that teaches principles and practice of malware detection, analysis, and defense. The course begins by introducing the foundations of malware, including history, vulnerability, types, analysis methods, and defenses. It then builds on this foundation by teaching students how to address malware issues using analysis techniques such as reverse engineering and static program analysis, as well as how to use analytic approaches such as automatic malware trace classification and clustering. The course relies extensively on hands-on laboratory activities to help students obtain practical experience in malware analysis and analytics. Through this course, the students will gain concrete understandings on principles and practices of malware analysis and defense.

**Enforced Prerequisite at Enrollment:** CYBER 262 and SRA 221 and SRA 231

**Enforced Prerequisite at Enrollment:** IST 242 and IST 261 and CYBER 262

**Enforced Prerequisite at Enrollment:** CYBER 399: Foreign Studies

1-12 Credits/Maximum of 12

Courses offered in foreign countries by individual or group instruction.

**International Cultures (IL)**