



Academic Assessment Report

Program - Cyber Security Engineering (BS)

Program General Information

Mission Statement

The mission of the undergraduate program in Cyber Security Engineering is to equip students with the ability to participate actively and productively in the engineering of a system that satisfies the needs of clients over the life cycle of the system. This includes the quantitative design of systems with proactive consideration and mitigation of cyber threats throughout the development life cycle. The term system is interpreted broadly, to be used in all industries to include but not limited to transportation, energy, healthcare, infrastructure, finance, government (federal, state, and local), and defense.

College/School

College of Engineering and Computing

Department/Division

Cyber Security Engineering

Assessment Contact

Dr. Peggy Brouse

Program - Cyber Security Engineering (BS): Assessment Report

Design within a constraint environment

an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

Outcome Status: Active

Assessment Period(s): 2023 - 2024

Does this Student Learning Outcome align with any of the following SCHEV Competencies?: Quantitative Reasoning

Is this Student Learning Outcome tied to an external accreditation standard?: Yes

Identify, formulate and solve engineering problems

an ability to identify, formulate, and solve engineering problems

Outcome Status: Active

Assessment Period(s): 2023 - 2024

Does this Student Learning Outcome align with any of the following SCHEV Competencies?: Critical Thinking

Is this Student Learning Outcome tied to an external accreditation standard?: Yes

Understand professional and ethical responsibility

an understanding of professional and ethical responsibility

Outcome Status: Active

Assessment Period(s): 2023 - 2024

Does this Student Learning Outcome align with any of the following SCHEV Competencies?: Civic Engagement

Is this Student Learning Outcome tied to an external accreditation standard?: Yes

Communicate effectively

an ability to communicate effectively

Outcome Status: Active

Assessment Period(s): 2023 - 2024

Program - Cyber Security Engineering (BS): Assessment Report

Does this Student Learning Outcome align with any of the following SCHEV Competencies?: Written Communication

Is this Student Learning Outcome tied to an external accreditation standard?: Yes

SLO 1 Design within a constraint environment

an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

Outcome Status: Active

Assessment Period(s): 2024 - 2025

Does this Student Learning Outcome align with any of the following SCHEV Competencies?: Quantitative Reasoning

Is this Student Learning Outcome tied to an external accreditation standard?: Yes

Assessment Method	Findings and Improvements
<p>Assessment Measure Name: SLO 1 Assessment Method</p> <p>Description of Assessment Measure: [CYSE 101] students learn the basic elements of cybersecurity and how to apply those principles and tools to engineering design so that system and data confidentiality, integrity, and availability are preserved. Final exam and risk analysis homework are used to measure the outcome.</p> <p>Assessment Measure Type: Direct Measure</p> <p>Assessment Measure Status: Active</p> <p>Achievement Target: Students are assessed as highly competent, competent or not competent. The target is to have 80% or more students with score of highly competent or competent.</p> <p>Supporting Documentation: BS-Cyber Security Engineering 2024 - 2025 completed template.xlsx; Rubrics for CYSE ABET Outcomes 1 - 7 Fall 2024.docx</p>	<p>Findings Date: 08/15/2025</p> <p>Findings: A change was made this semester in that groups were formed which researched, presented, and developed a paper on a specified case. Although case study questions also resided on the exams, the group work became the core of these measures. Groups did very well in this assignment. Presentations were lacking for some presenters but overall very good. The work was detailed and formulated professionally for the most part. The papers were formatted professionally and contained appropriate data. To allow creativity and further reinforcement of the case study facts, students were required to create a media form discussing their case study (video presentation, Cuckoo in-class quiz, live demonstration, etc.) Students were asked to use Virginia Cyber Range for all the labs. The results are considered consistent over the last semesters. The primary result indicates that students struggled with lab 5 particularly and the final exam. The scenarios used for analytical thinking and resulting resolutions were too complex or not easy to understand. Some students did not submit the assignments which also led to high NC rating. Overall, the students did well meeting the course criteria but a few items are noted: A small number of students have difficulty in mathematics, or concepts that should have been learned in prerequisite courses. These students were encouraged to read additional reading assignments; The instructor also provided some more fundamental lectures to get all the students toward the same level. In essence, students need additional problem solving skills.</p> <p>Reporting Period: 2024 - 2025</p> <p>Conclusion: Target Met</p> <p>Individual(s) Responsible for Assessment: CYSE 101 instructor</p>

Program - Cyber Security Engineering (BS): Assessment Report

Assessment Method	Findings and Improvements
	<p>Number of Students Assessed: 558</p> <p>Analysis of Results: 1. Students who are not competent lack critical thinking and basic knowledge of command line interface, network, and web. They demonstrated an inadequate understanding of how to manipulate systems and configured incorrect commands. 2. Students who are not competent is skewed by a number of no submissions by the students. Also, some students either did not turn in the labs or turned in late. Otherwise, the overall assessment of the results are fairly good. 3, Students struggled on exam problems. The NC level number is inflated somewhat because a number of students did not either submit the exam or certainly did not put much time into studying the materials. Yet the number of students who were considered NC certainly needs more guidance and further assistance in learning the materials.</p> <p>Supporting Documents: BS-Cyber Security Engineering 2024 - 2025 completed template.xlsx; Rubrics for CYSE ABET Outcomes 1 - 7 Fall 2024.docx; Student Outcomes Relation to Courses 2024-2025.pdf; CYSE Curriculum Map 2024-2025.pdf; Student Outcomes Relation to Courses 2024-2025.pdf</p> <p><u>ACTIONS & IMPROVEMENT PLANS</u></p> <p>Past Improvements: We will continue to evaluate student progress by creating Course Notebooks each semester for CYSE 101 that evaluates the courses against the outcomes. In Spring 2024, there were 4 sections of CYSE 101. This will include a Course Outcome Assessment Form (COAF) that contains the artifacts, measures and achievements for the students in the given class for the Outcome(s) pertaining to the class. Based on the competency of the students, the COAF contains recommended actions for curriculum improvement. The Course Notebooks that pertain to individual Outcomes are evaluated each year by a CYSE team to review achievement in the Outcome and to coordinate the recommendations from the different courses pertaining to the outcome. This is part of a detailed procedure for ABET compliance.</p>

Program - Cyber Security Engineering (BS): Assessment Report

Assessment Method	Findings and Improvements
	<p>Future Improvements: Observations: There is an overall improvement over the last 2-year cycle. Consensus is that SLO 1 is satisfied. The following notes are listed:</p> <ul style="list-style-type: none"> - Continue to have group work but update case focus each semester. - Faculty states that the scenarios used for analytical thinking and resulting resolutions were too complex or not easy to understand. Some students did not submit the assignments, which also led to high NC rating. Instructors will revisit the scenarios. Although the results could have been better, students apparently lack the necessary technical background to perform on some assignments. - The student population differs from semester to semester so technical background plays a significant role. Perhaps further explanation or implication of lab steps may result in higher outcomes. - The highest NC values in earlier semesters followed by significant improvement thereafter. Instructor delivery may have played a part. It is noticeable that the results improved after an instructor rearrangement. Continued monitoring individual instructor delivery. <p>Individual(s) Responsible for Improvement Plan: CYSE 101 instructor</p>

SLO 2 Identify, formulate and solve engineering problems

an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

Outcome Status: Active

Assessment Period(s): 2024 - 2025

Does this Student Learning Outcome align with any of the following SCHEV Competencies?: Critical Thinking

Is this Student Learning Outcome tied to an external accreditation standard?: Yes

Assessment Method	Findings and Improvements
<p>Assessment Measure Name: SLO 2 Assessment Method - Identify, formulate and solve engineering problems</p>	<p>Findings Date: 08/15/2025</p>

Program - Cyber Security Engineering (BS): Assessment Report

Description of Assessment Measure: [CYSE 425] In this course, the emphasis is in wireless network security, including WiFi systems, cellular systems, and Bluetooth systems. Students are required to quantize the security strength of a WPA2 password. Students are also required to understand basic wireless channel propagation model and apply it to explain the property of security protocols. Students conduct experiments using simulation software package to study and analyze the bit error rate (BER) performance for different scenarios of Signal-to-Noise Ratio.

Rubric:

Highly Competent This includes all of the following:

Student shows an ability to correctly formulate a mathematical / physical model from a description of a real physical system. Student shows a deep understanding of ways in which the model is deficient in terms of representing the real system Student can correctly analyze the system and make appropriately justified conclusions in order to solve the proposed engineering problem. Competent This may include one or more of the following:

Student shows an ability to formulate a mathematical / physical model from a description of a real physical system, though formulation may contain some minor errors Student shows an understanding of ways in which the model is deficient in terms of representing the real system, but may fail to identify the most significant deficiencies. Student takes correct approach to analyze the model, but makes some technical errors. Student displays near-correct interpretation of results; conclusions are mostly justified. Not Competent This may include one or more of the following:

Student shows little capability in formulating a mathematical / physical model from a description of a real physical system (e.g., the student appears to be just "writing equations"). Student shows little to no

Findings: [CYSE 425] The problem selected from Homework 1 tests student's knowledge of applying different encoding schemes, Frequency Hopping (FH) and Direct Sequence (DS) Spread Spectrum to counter eavesdropping, jamming and interference. The problem selected from Lab 5 tests student's ability of applying mathematical properties to explain the security of a wireless protocol. For rubrics 1a and 1b, more than 84% of students understand the mathematical foundations of the problems and are able to apply them to solve the problems. Less than 16% of students have difficulty in either understanding the problem correctly or explain the solutions through mathematical analysis. Some non-competent students have weak understanding of math, science and engineering principles. More than 84% of students did well on Midterm problem analysis.

Reporting Period: 2024 - 2025

Conclusion: Target Met

Individual(s) Responsible for Assessment: CYSE 425 instructor

Number of Students Assessed: 216

Analysis of Results: Overall, student aggregate numbers show higher than in the previous cycle. Therefore, SLO 2 is considered successful. Even so, some values require close monitoring by faculty and administration. Analysis indicated that:

1. Students who received a "Not Competent" did not seem to reach out much for help. In addition, faculty must encourage students to make use of the GTA and, as necessary, be more available for students who seem to be struggling with some of the fundamental concepts.
2. Several NC students did not submit the assignments or take the exams; hence, 0 resulted. This caused a higher than expected value for NC category. Increased focused to be exercised on specific course content. So that students can exercise more examples concerning thought and analysis.
3. Encourage students to read and try to prepare the structure of the assignments before the class and provide further guided similar activities. This will also help students that require more practice with concepts in class and improve exam results.
4. A significant number of students have difficulty in content that should have been learned in prerequisite courses. The instructor also provided some more fundamental lectures to get all the students toward the same level.

Supporting Documents:

[BS-Cyber Security Engineering 2024 - 2025 completed template.xlsx](#);

[Rubrics for CYSE ABET Outcomes 1 - 7 Fall 2024.docx](#);

[Student Outcomes Relation to Courses 2024-2025.pdf](#);

[CYSE Curriculum Map 2024-2025.pdf](#);

[Student Outcomes Relation to Courses 2024-2025.pdf](#)

ACTIONS & IMPROVEMENT PLANS

Program - Cyber Security Engineering (BS): Assessment Report

Assessment Method	Findings and Improvements
<p>understanding of model deficiencies; the student simply “trusts” that the model output is correct. Student makes serious technical errors in analyzing the model. Student shows little thought in interpreting model outputs (e.g., the student simply copies a graph to the report).</p> <p>Assessment Measure Type: Direct Measure Assessment Measure Status: Active Achievement Target: Students are assessed as highly competent, competent or not competent. The target is to have 80% or more students with score of highly competent or competent.</p> <p>Supporting Documentation: BS-Cyber Security Engineering 2024 - 2025 completed template.xlsx; Rubrics for CYSE ABET Outcomes 1 - 7 Fall 2024.docx</p>	<p>Past Improvements: [CYSE 425] To reduce the number of non-competent students, we plan to spend more time to go over mathematical principles in the beginning of the course, and provide more in-class practice and examples to help students understand the relevant mathematical tools and principles. We can provide students more examples of different encoding schemes to improve wireless channel security.</p> <p>Future Improvements: "Observations: - Several students frequently do not submit assignments or apply for exams, decreasing their grades. - Some students do not seek support from the faculties and TA/GTA after class (office hours). All the CYSE disciplines are contextualized with real problems, which is expected to increase students' engagement. The most critical complementary recommendation is to use study case exercises in the evaluation using (or based on) recent societal events. This does not ensure the engagement problem is solved; however, it could improve the final results. -To improve students' overall results, we suggest that instructors determine what may be called at-risk students within the first two or three class sessions. This enables them to pay more attention to these students and offer them assistance and meetings within office hours. The ideal would be to send the instructors the required ABET Course Outcome Assessment Form [COAF] at the start of the semester rather than near the end, helping them recognize how to work the competencies inside the evaluation plan. The Department must reinforce to students the importance of cybersecurity being a different course, given that it requires several different competencies from other engineering fields. "</p> <p>Individual(s) Responsible for Improvement Plan: CYSE 425 instructor</p>

SLO 3 Understand professional and ethical responsibility

an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

Outcome Status: Active

Assessment Period(s): 2024 - 2025

Does this Student Learning Outcome align with any of the following SCHEV Competencies?: Civic Engagement

Is this Student Learning Outcome tied to an external accreditation standard?: Yes

Program - Cyber Security Engineering (BS): Assessment Report

Assessment Method	Findings and Improvements
<p>Assessment Measure Name: SLO 3 Assessment Method - Understand professional and ethical responsibility</p>	<p>Findings Date: 08/15/2025</p> <p>Findings: Rubric 4a - Most students demonstrated a comfort in presenting both as individuals and in a team. The students begin presentations early in their program so that by the time they take CYSE 491, they are comfortable.</p> <p>Rubric 4b - The ethics assignment included debate of an engineering ethics topic. Overall, the student groups did a good job. The format works well. The Ethics debates are always a popular assignment. It is obvious which teams have prepared for the debate (both PRO and CON sides) and which have not. We lecture on the different aspects of ethics and the importance to cyber security engineering. The students then choose an ethics topic that is debated from both the PRO and CON perspective by two separate teams. The remainder of the class and the instructor complete an evaluation sheet of the debate. The exact format, including assigned duration for each part of the debate, are given to the teams. This format has proven to be very effective. We will continue to monitor the effectiveness of this method.</p> <p>Reporting Period: 2024 - 2025</p> <p>Conclusion: Target Met</p> <p>Individual(s) Responsible for Assessment: CYSE 491 instructor</p> <p>Number of Students Assessed: 259</p> <p>Analysis of Results: The Ethics Debates are a successful way to review Ethics. Background research on the Ethics topics must be detailed in order to debate either the PRO or CON side of a cyber security ethics issue. The research paper presentations were overall good. The students do get more comfortable presenting from the beginning to the end of the semester.</p> <p>Supporting Documents: BS-Cyber Security Engineering 2024 - 2025 completed template.xlsx; Rubrics for CYSE ABET Outcomes 1 - 7 Fall 2024.docx; Student Outcomes Relation to Courses 2024-2025.pdf; CYSE Curriculum Map 2024-2025.pdf; Student Outcomes Relation to Courses 2024-2025.pdf</p> <p><u>ACTIONS & IMPROVEMENT PLANS</u></p> <p>Past Improvements: The format for the debates has proven to be very effective. The instructors will continue to monitor the effectiveness of this method.</p>

Program - Cyber Security Engineering (BS): Assessment Report

Assessment Method	Findings and Improvements
<p>Description of Assessment Measure: As in all courses, students are reminded of their obligations under the Honor Code and sign an honor code pledge in the first class and on each exam. Students are expected to attend every class. They are required to sign in at the beginning of each class. Students are required to produce a professional design document and make a professional presentation for their course project. For the presentations, students are required to dress professionally. 10% the grade is based on class attendance and professionalism within the class. All students will be included in this measure for ABET. Student teams debate one another in order to examine the ethics in the engineering world as it pertains to cyber security. Two teams debate with one team taking the pro view and the other team taking the con view. The teams have an exact template for the debate including preset times for each section. The sections in the debate include: opening statements with arguments, clarifying questions asked by the opposing team, rebuttal of opposing teams position, summary of their position. In addition to the instructor, the remaining students in the class will score the debate using the scoring sheet. Appearance of team/seriousness of team, Team members participated equally, Opening statements were well organized, complete and included arguments to support their position, Opening statements arguments were related to ethical perspectives and principles, Clarifying questions pertained to the opposing team's arguments, Rebuttal was specific to position of opposing team, Summary provided and opponents' counterpoints addressed, Respect was shown throughout the debate for the opposing team, Quality of team's arguments throughout debate.</p> <p>Assessment Measure Type: Direct Measure Assessment Measure Status: Active</p>	<p>Future Improvements: "Observations: - The review team members continue to think that communication skills are a strength for our students. Students produced presentation material that had a logical sequence and conducted presentations in a professional manner. Adequate verbal mechanics (verbal clarity, fluency, pace, poise, eye contact, English usage, expression) were used. A few students did not submit the deliverables/assignments, but overall students displayed the expected competency to present their work to the audience. Students seem to prepare more diligently when faced with external reviewers, e.g., faculty or industry partners attending presentations, particularly in SAGE competition. Overall, the assignments for these courses are working adequately to assess SLO 3. -Improvement areas include detailed review of rubrics used for scoring the presentation and written proposal, posting previous examples from prior semesters for students to leverage as they prepare their material, and establishing a discipline category for CYSE 492/493 at SAGE competition. Such a distinction enhances the evaluations to be scored more so in the HC/C range. The previous competition evaluated CYSE presentation within the Software Engineering category. Faculty must offer continuous monitoring of outcomes and encouraging students' engagement in group ethics debate (CYSE 491). "</p> <p>Individual(s) Responsible for Improvement Plan: CYSE 491 instructor</p>

Program - Cyber Security Engineering (BS): Assessment Report

Assessment Method	Findings and Improvements
<p>Achievement Target: Students are assessed as highly competent, competent or not competent. The target is to have 99% or more students with score of highly competent or competent.</p> <p>Supporting Documentation: BS-Cyber Security Engineering 2024 - 2025 completed template.xlsx; Rubrics for CYSE ABET Outcomes 1 - 7 Fall 2024.docx</p>	

SLO 4 Communicate effectively

an ability to communicate effectively with a range of audiences

Outcome Status: Active

Assessment Period(s): 2024 - 2025

Does this Student Learning Outcome align with any of the following SCHEV Competencies?: Written Communication

Is this Student Learning Outcome tied to an external accreditation standard?: Yes

Assessment Method	Findings and Improvements
<p>Assessment Measure Name: SLO 4 Assessment Method - Communicate effectively</p>	<p>Findings Date: 08/15/2025</p> <p>Findings: [CYSE 491] The students communicated through both individual and group writing and presentation assignments. This is done so that individuals can be graded but also their ability to work on teams is evaluated. The students are required to tie their individual final research paper to the research necessary for their CYSE492 Senior Design project. The curriculum review presentations are given to the CYSE UG committee and are designed to obtain feedback from students regarding the CYSE curriculum.</p> <p>Reporting Period: 2024 - 2025</p> <p>Conclusion: Target Met</p> <p>Individual(s) Responsible for Assessment: CYSE 491 instructor</p> <p>Number of Students Assessed: 259</p>

Program - Cyber Security Engineering (BS): Assessment Report

Assessment Method	Findings and Improvements
<p>Description of Assessment Measure: George Mason University requires that each major program designate a writing intensive course, in which students are expected to produce and revise substantial written documents. CYSE491 Senior Seminar is the writing intensive course for the degree. The students must produce both group and individual writing materials. All of the papers/reports are formally evaluated by the professor and are part of their semester grade. Groups of students must present their position on an ethics question. Each group is required not only to argue their position, but also to present background material and their differing perspectives on the ethics question. In addition, as a group, students study one aspect of the curriculum and write a report including the subject statement, their research and suggestions for the faculty. They present their recommendations to the faculty. Individual papers include: report on the outside-of-class lecture given by an engineering professional, and the 5 page IEEE term paper required on a cyber security engineering bleeding edge topic. Several interim writing projects are associated with these assignments.</p> <p>Assessment Measure Type: Direct Measure</p> <p>Assessment Measure Status: Active</p> <p>Achievement Target: Students are assessed as highly competent, competent or not competent. The target is to have 80% or more students with score of highly competent or competent.</p> <p>Supporting Documentation: BS-Cyber Security Engineering 2024 - 2025 completed template.xlsx; Rubrics for CYSE ABET Outcomes 1 - 7 Fall 2024.docx</p>	<p>Analysis of Results: The individual presentations of THE final research paper were uniformly good. However, the written paper results were not as good as hoped. The less than competent students submitted papers that were not in IEEE format, didn't contain much original contribution, and were not deeply researched. Format for the paper and the expectations for the paper are given the first week of classes. Need to coordinate sections of paper every year with instructor for CYSE 492/493 Senior Design. This will give the students advance notice of the requirement. Currently students must present their paper topic, write a draft and final, and present the final paper. All of the groups did well in the Curriculum Review. They conducted surveys; analyzed the results and presented recommendations for the CYSE curriculum.</p> <p>Supporting Documents: BS-Cyber Security Engineering 2024 - 2025 completed template.xlsx; Rubrics for CYSE ABET Outcomes 1 - 7 Fall 2024.docx; Student Outcomes Relation to Courses 2024-2025.pdf; CYSE Curriculum Map 2024-2025.pdf; Student Outcomes Relation to Courses 2024-2025.pdf</p> <p>ACTIONS & IMPROVEMENT PLANS</p> <p>Past Improvements: Ensure that one boilerplate example of the IEEE format is given in class for the students to use for the paper + one completed example. We recommend continue monitoring the quality of the CYSE491 research papers and continue to have the Mason engineering librarian attend the CYSE491 class to lecture on the research resources available to the students in the library and the IEEE paper format. As in the past assessments, we recommend using as small a group size as practical to facilitate evaluating individual students' ability to create and deliver presentations. We also recommend that all instructors continue to emphasize presentation skills.</p> <p>Future Improvements: "Observations: The SLO 4 review team members continue to think that the result is satisfactory. However, recommend continued evaluation faculty delivery and content clarity. The review team noticed a change in faculty. It is also noted from the faculty recommendations that the number of projects and quality of those projects for CYSE 492/492 Senior Design are a challenge each year. This reason would definitely affect student motivation. Continuing monitoring of CYSE 491 and it's relation to CYSE 492/493."</p> <p>Individual(s) Responsible for Improvement Plan: CYSE 491 instructor</p>