# Program Approval

## I. General Information

**A. Institution:** Kansas State University

**B. Program Identification**

| | |
|---|---|
| Degree Level: | Bachelor's |
| Program Title | Cybersecurity |
| Degree to be Offered: | Bachelor of Science in Cybersecurity |
| Responsible Unit: | Department of Computer Science |
| CIP Code: | 11.1003 |
| Modality: | Hybrid |
| Proposed Implementation: | Fall 2022 |

Total Number of Semester Credit Hours for the Degree: 120

## II. Clinical Sites: Does this program require the use of Clinical Sites? No

## III. Justification

The demand for cybersecurity specialists is at an all-time high and growing rapidly. In December 2021, a report from Enterprise KC named "Establishing the State of Kansas as a Cybersecurity Center of Excellence" was prepared for the Kansas Department of Commerce (Kansas Department of Commerce). The report argues that the state of Kansas should establish itself as a leader in cybersecurity due to its unique position and growing tech and cybersecurity sectors. Some of the report's key findings were that the workforce supply has not kept pace and that increasing the educational pathways in cybersecurity across the state is critical.

According to data from cyberseek.org, the US employs 956,341 cybersecurity professionals, with 464,420 openings as of September 2021 (Cyber Seek). In Kansas, there are 6,543 employed cybersecurity professionals with 2,535 open jobs. The KC metro area (including Missouri) has 7,350 employed with 3,149 openings, and the Wichita area has 1,148 employed with 476 openings. When we compare these numbers to 2019 Cyber Seek data that showed there were 4,789 cybersecurity professionals employed in Kansas with 1,785 open positions, we see that the number of cybersecurity professionals employed and the number of open positions have increased by 27.8% and 40.9%, respectively.

Cyber Seek data also shows very high demand. Across all occupations, there are currently 3.9 employed workers for every job opening, but within cybersecurity, there are only 2.1 workers for each job opening. This translates into difficulty in hiring.

In their 2019 *State of Cybersecurity* report, ISACA found that most organizations' open cybersecurity positions are for technical professionals as opposed to nontechnical or managerial (ISACA). However, only 24% of those organizations reported that they believed that recent university graduates in cybersecurity are well prepared for the challenges in their organizations, and only 20% of organizations felt that 50% or more of their applicants were actually qualified for those positions. These facts indicate a need for higher quality technically trained graduates such as will be provided by an accredited degree.

Cybersecurity degrees have been poorly accepted by hiring managers due mostly to insufficient general Computer Science background. Great strides were made as ABET, the international accrediting body for engineering and computer science, has recently begun accrediting Cybersecurity degree programs through their Computing Accreditation Commission (ABET, 2018). Upon approval of this program, we will seek accreditation from this

ABET commission. The accreditation process occurs every six years. It includes the preparation of a self-study by each program, review of randomly selected transcripts of recent graduates to ensure that degree requirements are being enforced, and a site visit by evaluators, who review materials collected from courses, and interview students, faculty, and administrators. We plan to synchronize this process with the review of the B.S. in Computer Science and the Engineering degree programs accredited through the Engineering Accreditation Commission. Hence, we would submit the self-study in the summer of 2023, and the site visit would occur that fall. We would then expect to receive accreditation in the summer of 2024.

Fortunately, the accreditation requirements for a Cybersecurity degree are very close to our existing Cybersecurity Option for our BS in Computer Science. In the Fall of 2019 (when it was first offered), the Cybersecurity Option enrolled 2 students, while in Fall 2021 there were 11 students enrolled.

The proposed B.S in Cybersecurity has the following educational objectives for our graduates to have accomplished within a few years of their graduation:

- Graduates will have progressed in the cybersecurity field by either obtaining an advanced technical or management position, exhibiting entrepreneurial activities or obtaining a graduate degree.
- Graduates will have contributed to societal needs by working with others to develop resilient and secure software systems.
- Graduates will be committed to lifelong learning and contributing back to the profession.
- Graduates will be committed to professional and ethical standards established by related professional societies.

## IV. Program Demand: Market Analysis

The primary markets for this major are students who wish to work in the cybersecurity field long-term, thus requiring a baseline knowledge of computer science with a specialization/focus in cybersecurity, information security, information assurance, etc.

Currently, there are only 13 accredited cybersecurity programs in the US (ABET, 2021). Of these, only three are in the central plains region: the University of Central Missouri, Fontbonne University, and Southeast Missouri State University. Within the state of Kansas, there are no other cybersecurity degree programs – accredited or not – at the undergraduate level. The University of Kansas has MS and PhD programs in cybersecurity, but none at the undergraduate level. Wichita State University has a BS in Engineering Technology with a Cybersecurity option, but no computer science-based cybersecurity undergraduate programs. Fort Hays State University has a BA/BS in Information Networking and Telecommunications with a concentration in Computer Networking and Telecommunications with an Information Assurance Emphasis. Emporia State University and Pittsburg State University do not have any type of cybersecurity degrees. Thus, not only would a computer science-based BS in Cybersecurity at Kansas State University be unique in Kansas, but K-State would only be one of two Research 1 universities offering a BS in Cybersecurity in the plains region and the only Research 1 university with a computer science-based BS in Cybersecurity in the plains region.

The demand among students for Cybersecurity courses has been strong for several years. Since 2018, the K-State computer science introductory undergraduate cybersecurity course has averaged over 27 students each year, while the overall enrollment in all cybersecurity courses has averaged 84 students a year.

We expect this program to be popular with incoming freshmen interested in security-specific jobs in the tech industry. We also expect this to be a popular double-major with Computer Science. Few institutions currently have accredited Cybersecurity degrees, and we expect a formally accredited program to be well-perceived by industry. Furthermore, we are in a unique position, having already established the Cybersecurity Option, to be one of the first major universities to offer an accredited Cybersecurity degree.

## V. Projected Enrollment:

The numbers above suggest that we could have 25-50 students enrolled in the program within four years. For this reason, we have prepared a scalable set of courses for all of our requirements that can accommodate a large influx of students as needed.

We have also performed several budget simulations based on low enrollment numbers to minimize our risk and analyze program viability. We believe the numbers presented below are conservative estimates for the students, given that there were 13 computer science students enrolled in the Cybersecurity option of our Computer Science degree program in Spring 2021. Our estimates of enrollment are as follows:

| Year | Total Headcount Per Year | | Total Sem Credit Hours Per Year | |
|---|---|---|---|---|
| | Full-Time | Part-Time | Full-Time | Part-Time |
| **Implementation** | 15 | 2 | 450 | 24 |
| **Year 2** | 25 | 4 | 750 | 48 |
| **Year 3** | 35 | 5 | 1,050 | 60 |

## VI. Employment

As shown below in Table 1, the Bureau of Labor Statistics predicts that the job market for information security analysts (cybersecurity specialist requiring a bachelor's degree) is expected to grow 31% from 2019 to 2029 (Bureau of Labor Statistics). This demonstrates the phenomenal growth of cybersecurity at the national level. When coupled with the median pay of $103,590 per year, the field will be very enticing to students.

*Table 1. Bureau of Labor Statistics for Information Security Analysts* (Bureau of Labor Statistics, 2019)

| | |
|---|---|
| 2020 Median Pay | $103,590 per year |
| Typical Entry-Level Education | Bachelor's degree |
| Work Experience in a Related Occupation | Less than 5 years |
| On-the-job Training | None |
| Number of Jobs, 2019 | 131,000 |
| Job Outlook, 2019-2029 | 31% (Much faster than average) |
| Employment Change, 2019-29 | 40,900 |

As discussed above, Kansas currently employs over 6,500 cybersecurity professionals while there are over 2,500 open jobs, and these number have increased by 27.8% and 40.9% respectively in one year. Those numbers, coupled with the limited accredited Cybersecurity degree options available will make our graduates highly sought after.

## VII. Admission and Curriculum

### A. Admission Criteria

Students must first be admitted to the Carl R. Ice College of Engineering, which has admission requirements of 3.25 high school GPA for first-year students and 2.75 cumulative GPA on transfer courses for transfer students. All new students will be initially admitted to the Computer Science pre-professional program and must subsequently be admitted to the professional program before completing the Cybersecurity degree. (*This pathway mirrors the B.S. in Computer Science degree program.*)

In order to be considered for admission to the professional program, a student must have:

1. Passed all pre-professional program courses with a C or better;
2. Achieved at least a 2.3 GPA on all pre-professional courses (including transfer courses); and
3. Received credit in CIS 015 Undergraduate Seminar.

Additionally, an application to the professional program must be submitted to the Department of Computer Science by the end of the eighth week of either the Spring or Fall semester. This submission will be immediately prior to the student's pre-enrollment into any of the professional program courses.

All courses in the pre-professional program must be completed and all grade criteria must be met by the end of the semester that the application is submitted. An exception to this rule is the student who expects to complete these criteria during the summer term. Those students should also make application in the Spring semester prior to pre-enrollment. All eligible applicants will be allowed to pre-enroll into professional program courses with the understanding that they will be dropped if they are not accepted for admission to the professional program prior to the beginning of the subsequent semester.

Applications will be reviewed by the Curriculum Committee of the Department and accepted or rejected as soon as possible after semester grades are issued. The number of students admitted in any given semester will be limited by the number of seats available. If the number of applicants who meet the grade requirements listed above exceeds the number of seats available, then in addition to the minimum grade requirements listed above, the admission will be determined a holistic evaluation of the following factors:

- Grades in college-level courses, particularly computing courses;
- Communication skills;
- Activities and service;
- Socioeconomic disadvantage;
- Status as first-generation college student; and
- History of overcoming personal hardship.

Students who have completed the pre-professional program with the required grades but are denied admission may re-apply in a later semester. Students who have been dismissed from the Computer Science professional program must be readmitted to that program prior to being admitted to the Cybersecurity professional program.

**B. Curriculum**

The semester-by-semester curriculum is as follows:

**Year 1: Fall Semester Credit Hours**

| Course # | Course Name | SCH=15-16 |
|---|---|---|
| ARCH 301 | Appreciation of Architecture | 3 |
| CIS 015 | Undergraduate Seminar | 0 |
| CIS 115 | Introduction to Computing Science | 3 |
| COMM 105/106 | Public Speaking I | 2-3 |
| ENGL 100 | Expository Writing | 3 |
| MATH 220 | Analytic Geometry and Calculus I | 4 |

**Year 1: Spring**

| Course # | Course | SCH = 15 |
|---|---|---|
| CHM 210 | CHM 210 Chemistry I | 4 |
| CIS 200 | Programming Fundamentals | 4 |
| ECE 241 | Introduction to Computer Engineering | 3 |
| MATH 221 | Analytic Geometry and Calculus II | 4 |

**Year 2: Fall**

| Course # | Course | SCH = 15 |
|---|---|---|

| | | |
|---|---|---|
| COMM 322 | Interpersonal Communication | 3 |
| CIS 300 | Data and Program Structures | 3 |
| CIS 301 | Logical Foundations of Programming | 3 |
| ECON 110 | Principles of Macroeconomics | 3 |
| ENGL 200 | Expository Writing II | 3 |

**Year 2: Spring**

| Course # | Course | SCH = 16 |
|---|---|---|
| SOCIO 211 | Introduction to Sociology | 3 |
| MATH 506 | Introduction to Number Theory | 3 |
| THTRE 261 | Fundamentals of Acting | 3 |
| CIS 400 | Object-Oriented Design, Implementation and Testing | 3 |
| MATH 510 | Discrete Mathematics | 3 |
| CIS 308 | C Language Laboratory | 1 |

**Year 3: Fall**

| Course # | Course | SCH = 16 |
|---|---|---|
| SOCIO/CRIM 550 | Technocrime, Security, and Society | 3 |
| CHM 230 | Chemistry II | 4 |
| CIS 501 | Software Architecture and Design | 3 |
| CIS 415 | Ethics and Conduct for Computing Professionals | 3 |
| CIS 560 | Database Systems | 3 |

**Year 3: Spring**

| Course # | Course | SCH = 15 |
|---|---|---|
| PHILO 120 | Introduction to Philosophy of Art | 3 |
| CIS 450 | Computer Architecture and Operations | 3 |
| CIS 575 | Introduction to Algorithmic Analysis | 3 |
| ENGL 415/516 | Written Communications for Engineers/Written Communications for the Sciences | 3 |
| STAT 510 | Introduction to Probability and Statistics | 3 |

**Year 4: Fall**

| Course # | Course | SCH = 15 |
|---|---|---|
| CIS 551 | Fundamentals of Computer and Information Security | 3 |
| CIS 525 | Introduction to Computer Networks | 3 |
| CIS 505 | Introduction to Programming Languages | 3 |
| CIS 655/755 | Security and Reliability of Computing Systems / Systems Security | 3 |
| MATH 551 | Applied Matrix Theory | 3 |

**Year 4: Spring**

| Course # | Course | SCH=12 |
|---|---|---|
| CIS 553 | Fundamentals of Cryptography | 3 |
| CIS 599 | Cybersecurity Project | 3 |
| STAT 511 | Introductory Probability and Statistics II | 3 |
| CIS 580 | Fundamentals of Game Programming | 3 |

**Total Number of Semester Credit Hours** ..... 120

## VIII. Core Faculty FTE: 1.0 FTE = Full-Time Equivalency Devoted to Program

The core faculty for the Cybersecurity program consists of three faculty members from the Department of Computer Science in the Carl R. Ice College of Engineering who specialize in cybersecurity. There will be many other faculty involved who are already teaching other degree courses as part of existing programs. The faculty listed below represent the core faculty who will meet regularly to guide and assess the program.

| Faculty Name | Rank | Highest Degree | Tenure Track Y/N | Academic Area of Specialization | FTE to Proposed Program |
|---|---|---|---|---|---|
| * Eugene Vasserman | Assoc Professor | PhD | Y | Computer Science | 0.125 |
| George Amariucai | Assoc Professor | PhD | Y | Computer Science | 0.125 |
| Arslan Munir | Assoc Professor | PhD | Y | Computer Science | 0.125 |

* Denotes Program Coordinator

**Number of graduate assistants assigned to this program** …… 0 additional from Computer Science Cybersecurity classes are also offered as part of the Computer Science B.S. and therefore no *additional* graduate assistant hours are needed.

## IX. Expenditure and Funding Sources

| **A. EXPENDITURES** | First FY | Second FY | Third FY |
|---|---|---|---|
| **Personnel – Reassigned or Existing Positions** | | | |
| Faculty | $40,750 | $41,565 | $42,397 |
| Administrators *(other than instruction time)* | $0 | $0 | $0 |
| Graduate Assistants | $8,000 | $16,320 | $16,646 |
| Support Staff for Administration (*e.g., secretarial*) | $0 | $0 | $0 |
| Fringe Benefits *(total for all groups)* | $14,320 | $15,912 | $16,230 |
| Other Personnel Costs | $0 | $0 | $0 |
| ***Total Existing Personnel Costs – Reassigned or Existing*** | $63,070 | $73,797 | $75,273 |
| | | | |
| **Personnel – New Positions** | | | |
| Faculty | $0 | $0 | $0 |
| Administrators *(other than instruction time)* | $0 | $0 | $0 |
| Graduate Assistants | $0 | $0 | $0 |
| Fringe Benefits *(total for all groups)* | $0 | $0 | $0 |
| Other Personnel Costs | $0 | $0 | $0 |
| ***Total Existing Personnel Costs – New Positions*** | $0 | $0 | $0 |
| | | | |
| **Start-up Costs – One-Time Expenses** | | | |
| Library/learning resources | $0 | $0 | $0 |
| Equipment/Technology | $0 | $0 | $0 |
| Physical Facilities: Construction or Renovation | $0 | $0 | $0 |
| Program Accreditation and Upkeep | $0 | $3,285 | $0 |
| Total Start-up Costs | $0 | $0 | $0 |
| | | | |
| **Operating Costs – Recurring Expenses** | | | |
| Supplies/Expenses | $0 | $0 | $0 |
| Library/learning resources | $0 | $0 | $0 |
| Equipment/Technology | $0 | $0 | $0 |
| Program Accreditation and Upkeep | $0 | $0 | $700 |

| | | | |
|---|---|---|---|
| | | | |
| **Total Operating Costs** | $0 | $0 | $700 |
| | | | |
| **GRAND TOTAL COSTS** | $63,070 | $77,082 | $75,973 |

| **B. FUNDING SOURCES (projected as appropriate)** | Current | First FY (New) | Second FY (New) | Third FY (New) |
|---|---|---|---|---|
| Tuition / State Funds | | $149,926 | $252,407 | $351,093 |
| Student Fees | | $24,565 | $41,315 | $57,505 |
| Other Sources | | $0 | $0 | $0 |
| **GRAND TOTAL FUNDING** | | $174,491 | $293,722 | $408,598 |
| **C. Projected Surplus/Deficit** (+/-) (Grand Total Funding minus Grand Total Costs) | | $111,421 | $216,640 | $332,625 |

## X. Expenditures and Funding Sources Explanations

### A. Expenditures

**Personnel – Reassigned or Existing Positions**

All core faculty are currently employed by Kansas State University in the College of Engineering. These faculty members already teach the cybersecurity courses required for the Cybersecurity degree as part of their normal load.

No new faculty or instructor hires are required to initiate or maintain the new program. The percent time dedicated to the program varies by faculty member and the courses taught each year by applying a general rule of 0.125 FTE per in-person course or 0.0625 FTE per online course. As Program Coordinator, Dr. Eugene Vasserman will assist the Department of Computer Science Head (Dr. Scott DeLoach) and Undergraduate Program Director (Dr. Rod Howell) in administering the program within the Department of Computer Science. For budgeting purposes, all salary (faculty, graduate teaching assistants, and administrative support) include a modest 2% pay increase after the first fiscal year.

### B. Personnel – New Positions

No new positions are required to initiate the proposed program.

### C. Start-Up Costs – One-Time Expenses

There are no additional one-time startup expenses associated with the program. When we seek ABET accreditation there will be a one-time fee of $3,285 (ABET, 2022).

### D. Operating Costs – Recurring Expenses

There are no additional recurring costs. Laboratories used for teaching cybersecurity courses are used in conjunction with other computer science courses and will be kept up to date by the Department of Computer Science. The department will use the current revenue sources used for supporting all computer science laboratories, namely part of the College of Engineering fee amount, which is approximately $19 per student credit hour. As the number of cybersecurity students grows, they will be contributing to the computer science fund for each computer science course they take. ABET charges a $700 yearly program upkeep fee to maintain accreditation between site visits (ABET, 2022).

### E. Revenue: Funding Sources

The following revenue table uses an in-state, on-campus tuition figure of $316.30 per credit hour and assumes that approximately 61% of all semester credit hours (SCH) are generated by the College of Arts and Sciences (COAS) and 39% are generated by the Carl R. Ice College of Engineering (COE) respectively.

This analysis is limited in scope to on-campus students so the overall revenue is expected to be higher when this degree is offered, i.e., any students taking the course online will generate even more revenue than projected here as additional online fees are collected for both COAS and COE courses.

COAS has a general fee of $17.40 per credit hour for on-campus courses, while the COE has a general fee of $105.60 per credit hour. All funds generated by fees will be retained by the generating college.

| Tuition & Fees | Tuition per SCH | YR 1 SCH | Sub-Totals | YR 2 SCH | Sub-Totals | YR 3 SCH | Sub-Totals |
|---|---|---|---|---|---|---|---|
| In-State On-Campus Tuition | $316.30 | 474 | $149,926 | 798 | $252,407 | 1110 | $351,093 |
| COE Fees | $105.60 | 185 | $19,536 | 311 | $32,842 | 433 | $45,725 |
| COAS Fees | $17.40 | 289 | $5,029 | 487 | $8,474 | 677 | $11,780 |
| **Total Revenue** | | | **$174,491** | | **$293,723** | | **$408,598** |

### F. Projected Surplus/Deficit

Our estimate suggests that this program will be highly profitable from the first year due to the use of existing courses and the program similarity to the existing Computer Science major with Cybersecurity Option. Projected surpluses are also sufficient to maintain appropriate IT support infrastructure throughout the lifetime of the program at no additional cost to the university.

## XI. References


ABET. (2018). *ABET Approves Accreditation Criteria for Undergraduate Cybersecurity Programs*. Retrieved September 2021, from https://www.abet.org/abet-approves-accreditation-criteria-for-undergraduate-cybersecurity-programs/

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