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| For Academic Affairs and Research Use Only |
| CIP Code:  |  |
| Degree Code: |  |

**New Emphasis, Concentration or Option Proposal Form**

**[ ] Undergraduate Curriculum Council**

**[X] Graduate Council**

Signed paper copies of proposals submitted for consideration are no longer required. Please type approver name and enter date of approval.

Email completed proposals to curriculum@astate.edu for inclusion in curriculum committee agenda.

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| Edward Hammerand | 9/27/2017 |

**Department Curriculum Committee Chair** |

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**COPE Chair (if applicable)** |
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| Hung-Chi Su | 9/27/2017 |

**Department Chair:**  |

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**Head of Unitb (If applicable)**   |
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| David F. Gilmore | 10/6/2017 |

**College Curriculum Committee Chair** |

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**Undergraduate Curriculum Council Chair** |
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| Anne A. Grippo  | 10/6/2017 |

**College Dean** |

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**Graduate Curriculum Committee Chair** |
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**General Education Committee Chair (If applicable)**   |

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**Vice Chancellor for Academic Affairs** |

**i. Proposed Program Title**

Master of Science in Computer Science with Emphasis in Cyber Security

**ii. Contact Person** (Name, Email Address, Phone Number)

Dr. Hung-Chi Su, suh@astate.edu, 870-680-8119

**iii. Proposed Starting Date**

Spring 2018

**Bulletin Changes**

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| **Instructions**  |
| **Please visit** [**http://www.astate.edu/a/registrar/students/bulletins/index.dot**](http://www.astate.edu/a/registrar/students/bulletins/index.dot) **and select the most recent version of the bulletin. Copy and paste all bulletin pages this proposal affects below. Follow the following guidelines for indicating necessary changes.** **\*Please note: Courses are often listed in multiple sections of the bulletin. To ensure that all affected sections have been located, please search the bulletin (ctrl+F) for the appropriate courses before submission of this form.** - Deleted courses/credit hours should be marked with a red strike-through (~~red strikethrough~~)- New credit hours and text changes should be listed in blue using enlarged font (blue using enlarged font). - Any new courses should be listed in blue bold italics using enlarged font (***blue bold italics using enlarged font***)*You can easily apply any of these changes by selecting the example text in the instructions above, double-clicking the ‘format painter’ icon 🡪 , and selecting the text you would like to apply the change to.* *Please visit* [*https://youtu.be/yjdL2n4lZm4*](https://youtu.be/yjdL2n4lZm4) *for more detailed instructions.* |

Insert between page 262 and page 263 of 2017-18 Graduate Bulletin:

Computer Science

Master of Science

Emphasis in Cyber Security

University Requirements:

 See Graduate School Degree Policies for additional information (p. 35)

Program Requirements:

Minimum of eighteen hours of 6000 level Computer Science and approved Mathematics and/or Statistics coursework inclusive of thesis.

Sem. Hrs.

Theory: 3

CS 5133, Compiler

OR

CS 5723, Automata Theory

Systems (select one of the following): 3

CS 5313, Computer Networks

CS 6213, Parallel Processing

CS 6243, Distributed Systems

CS 6253, Heterogeneous Computing

Algorithms: 3

CS 5713, Analysis of Algorithms

Emphasis Area (Cyber Security):

CS 6313, Data Security 3

CS 6323, Computer Security 3

CS 6333, Network and Internet Security 3

Emphasis Elective (select one of the following): 3

CS 6123, Software Security

CS 6343, Cloud Security

LAW 6033, Cyberlaw and E-Commerce

CS Electives 6

CS, MATH, and/or STAT Electives, 6

Subject to the prior approval of the Computer Science Curriculum Committee.

Sub-total 33

Total Required Hours: 33

**EMPHASIS ASSESSMENT**

**University Goals**

1. Please indicate the university-level student learning outcomes for which this new emphasis will contribute. Check all that apply.

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| * 1. **[ ]** Global Awareness
 | * 1. **[X]** Thinking Critically
 | * 1. **[X]** Information Literacy
 |

**Emphasis Goals**

2. Justification for the introduction of the new emphasis. Must include:

1. Academic rationale (how will this emphasis fit into the mission established by the department for the curriculum?)
 The emphasis addresses the department’s ongoing need to add curriculum reflecting new concepts and technologies in computer science. The rapid growth in security issues in recent years brings great attention and challenges to computer science in academia, industry and government, placing high demands on professionals in this field.
2. List emphasis goals (faculty or curricular goals, specific to the emphasis.)
* Students will possess a strong foundational knowledge of the theory and application of cyber security algorithms and processes.
* Students will have the ability to identify and analyze cyber security problems and to implement the solutions.

d. Student population served.

Graduate students

**Emphasis Student Learning Outcomes**

3. Please fill out the following table to develop a continuous improvement assessment process for this emphasis.

*For further assistance, please see the ‘Expanded Instructions’ document available on the UCC - Forms website for guidance, or contact the Office of Assessment at 870-972-2989.*

***Note: Best practices suggest an emphasis would have 1 to 3 outcomes.***

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| **Outcome 1** | A deeper understanding of the theory and application of cyber security algorithms and processes. |
| Assessment Procedure Criterion | Comprehensive examinations and employer surveys  |
| Which courses are responsible for this outcome? | CS 6123, Software SecurityCS 6313, Data Security CS 6323, Computer SecurityCS 6333, Network and Internet SecurityCS 6343, Cloud Security |
| Assessment Timetable | Comprehensive exams will be conducted each semester, reviewed annually, and reported on every three years; employer surveys will be conducted each fall and reported on every four years. |
| Who is responsible for assessing and reporting on the results? | Department assessment committee |

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| **Outcome 2** | The ability to apply cyber security analysis techniques to problem identification. |
| Assessment Procedure Criterion | Comprehensive examinations and employer surveys  |
| Which courses are responsible for this outcome? | CS 6123, Software SecurityCS 6313, Data Security CS 6323, Computer SecurityCS 6333, Network and Internet SecurityCS 6343, Cloud SecurityLAW 6033, Cyberlaw and E-Commerce  |
| Assessment Timetable | Comprehensive exams will be conducted each semester, reviewed annually, and reported on every three years; employer surveys will be conducted each fall and reported on every four years. |
| Who is responsible for assessing and reporting on the results? | Department assessment committee |

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| **Outcome 3** | The ability to apply cyber security implementation techniques to problem solution. |
| Assessment Procedure Criterion | Comprehensive examinations and employer surveys  |
| Which courses are responsible for this outcome? | CS 6123, Software SecurityCS 6313, Data Security CS 6323, Computer SecurityCS 6333, Network and Internet SecurityCS 6343, Cloud Security |
| Assessment Timetable | Comprehensive exams will be conducted each semester, reviewed annually, and reported on every three years; employer surveys will be conducted each fall and reported on every four years. |
| Who is responsible for assessing and reporting on the results? | Department assessment committee |

*Please repeat as necessary.*

**LETTER OF NOTIFICATION – 3
NEW OPTION, CONCENTRATION, EMPHASIS**(Maximum 18 semester credit hours of new theory courses and 6 credit hours of new practicum courses)

1. Institution submitting request:

Arkansas State University

2. Contact person/title:

 Dr. Hung-Chi Su, Chair of the Department of Computer Science

3. Phone number/e-mail address:

 870-680-8119, suh@astate.edu

4. Proposed effective date:

Spring 2018

5. Title of degree program: (Indicate if the degree listed above is approved for distance delivery)

Master of Science in Computer Science

6. CIP Code:

11.0101

7. Degree Code:

6180

8. Proposed name of new option/concentration/emphasis:

Cyber Security

9. Reason for proposed action:

There is a rising demand for students who have expertise in cyber security from corporations, nonprofit companies, and agencies. A digitally literate workforce using technology in a secure manner is imperative to these companies as well as the economy as a whole, and it provides security to an already critical infrastructure.

10. New option/emphasis/concentration objective:

 This emphasis will prepare students to have a set of cybersecurity strategies and skills that can be used in a career to improve performance, add responsibilities, and earn promotions.

11. Provide the following:

* 1. Curriculum outline - List of courses in new option/concentration/emphasis – Underline required courses

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| CS 6313, Data Security |
| CS 6323, Computer Security |
| CS 6333, Network and Internet Security |
| CS 6123, Software Security |
| CS 6343, Cloud Security |
| LAW 6033, Cyberlaw and E-Commerce |

* 1. Provide degree plan that includes new option/emphasis/concentration

|  |  |  |
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| **Course Number** | **Course** **Name** | **Credit Hours** |
| CS 5713 | Analysis of Algorithms | 3 |
| Choose One of the Following: |
| CS 5133 | Compilers | 3 |
| CS 5723 | Automata Theory |
| Choose One of the Following: |
| CS 5313 | Computer Networks | 3 |
| CS 6213 | Parallel Processing |
| CS 6243 (pre fall 2017 #s were 6233 & 6823) | Distributed Systems |
| CS 6253 (pre fall 2017 #s were 6223 & 6823) | Heterogeneous Computing (pre fall 2017 name was High Performance Computing) |
| Cyber Security Emphasis: |
| CS 6313 | Data Security | 3 |
| CS 6323 | Computer Security | 3 |
| CS 6333 | Network and Internet Security | 3 |
| Choose one of the Following: |
| CS 6123 | Software Security | 3 |
| CS 6343 | Cloud Security |
| LAW 6033 | Cyberlaw and E-Commerce |
| Electives | Computer Science Electives | 6 |
| Electives | Computer Science, Math, or Stats Electives | 6 |
| Total |  | 33 |

* 1. Total semester credit hours required for option/emphasis/concentration

 (Option range: 9–24 semester credit hours)

 12

* 1. New courses and new course descriptions
* CS 6123, Software Security (*originated as subject in previous undergraduate special problem class CS482V*)
Study of security issues in the software development process, including security management, secure software development lifecycle, language security, and web application security.
* CS 6323, Computer Security (*offered previously as part of a special topics subject, CS6823*)
Survey of the latest security issues in computer systems, including topics such as authentication, access control, database security, operating system security, security management, and trust and privacy in computing.
* CS 6333, Network and Internet Security (*offered previously as part of a special topics subject, CS6823*)
Survey of network authentication, network access control, key management in networked systems, network security protocols, network security software and packages, and network security auditing.
* CS 6343, Cloud Security (*offered previously as a special topics subject, CS6823*)
Survey of the major security aspects of cloud computing and the corresponding mechanisms, including cloud security management, architecture and measurement as well as virtual machine security and real world cloud security examples.
	1. Goals and objectives of program option
* Students will possess a strong foundational knowledge of the theory and application of cyber security algorithms and processes.
* Students will have the ability to identify and analyze cyber security problems and to implement the solutions.
	1. Expected student learning outcomes

Students will have:

* a deeper understanding of the theory and application of cyber security algorithms and processes.
* the ability to apply cyber security analysis techniques to problem identification.
* the ability to apply cyber security implementation techniques to problem solution.
	1. Documentation that program option meets employer needs

*According to NetworkWorld, there is a high demand for cybersecurity skill sets, however there is a shortage of individuals with these skills. “According to ESG (Enterprise Strategy Group) research, 46 percent of organizations say they have a ‘problematic shortage’ of cybersecurity skills in 2016.”*[*http://www.networkworld.com/article/3068177/security/high-demand-cybersecurity-skill-sets.html*](http://www.networkworld.com/article/3068177/security/high-demand-cybersecurity-skill-sets.html) *According to the Colorado Springs Gazette there is a record 79 percent of American businesses who have reported a cybersecurity incident in 2014. Also, 238,158 job postings for cyber security positions represented a 91% increase from 2010.*[*http://gazette.com/cybersecurity/education*](http://gazette.com/cybersecurity/education) *According to the Bureau of Labor Statistics, the typical education required for an Information Security Analyst position is a Bachelor’s degree with a job outlook of 18% increase from 2014-2024.*[*http://www.bls.gov/ooh/computer-and-information-technology/information-security-analysts.htm*](http://www.bls.gov/ooh/computer-and-information-technology/information-security-analysts.htm)

* 1. Student demand (projected enrollment) for program option

 40

* 1. Name of institutions offering similar program or program option and the institution(s) used as a model to develop the proposed program option

Boston University

George Washington University

Wright State University

Model used to develop program was the A-State M.S. in Computer Science program

12. Institutional curriculum committee review/approval date:

13. Will the new option/emphasis/concentration be offered via distance delivery? No

 If yes, indicate mode of distance delivery:

 Enter text...

14. Explain in detail the distance delivery procedures to be used:

 N/A

15. Specify the amount of additional costs required for program implementation, the source of funds, and how funds will be used.

 The subjects of all of the new courses involved have previously been offered as special topics subjects; replacing special topics offerings with regular bulletin courses and revising the course rotation accordingly means that there will be no extra funds required.

16. Provide additional program information if requested by ADHE staff.

President/Chancellor Approval Date: Click here to enter a date.

Board of Trustees Notification Date: Click here to enter a date.

Chief Academic officer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: Enter date.

 Name (printed): Click here to enter text.