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

**Program Modification Form**

**[ ] Undergraduate Curriculum Council**

**[ x] Graduate Council**

|  |
| --- |
| **Modification Type: [ ]Admissions, [ ]Curricular Sequence, or [ x]Other** |

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

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| --- | --- | --- | --- | --- | --- |
| |  |  | | --- | --- | | Hai Jiang | 2/28/2022 |   **Department Curriculum Committee Chair** | |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Enter date |   **COPE Chair (if applicable)** |
| |  |  | | --- | --- | | Christos Grecos | 2/28/2022 |   **Department Chair** | |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Enter date |   **Head of Unit (if applicable)** |
| |  |  | | --- | --- | | Brandon Kemp | 3/4/2022 |   **College Curriculum Committee Chair** | |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Enter date |   **Undergraduate Curriculum Council Chair** |
| |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Enter date |   **Director of Assessment** *(only for changes impacting assessment)* | |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Enter date |   **Graduate Curriculum Committee Chair** |
| |  |  | | --- | --- | | Abhijit Battacharyya | 3/4/2022 |   **College Dean** | |  |  | | --- | --- | | Alan Utter | 3/31/2022 |   **Vice Chancellor for Academic Affairs** |
| |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Enter date |   **General Education Committee Chair (if applicable)** |  |

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

Christos Grecos cgrecos@astate.edu, ext 3938

1. **Proposed Change** (for undergraduate curricular changes please provide an 8-semester plan (appendix A), if applicable)

Update the bulletin to state the conditions under which the comprehensive exam is waved for the MS in Computer Science (general and emphasis options)

Adding new course CS 6273 Quantum Computing to MS Emphasis in High Performance Computing and High Performance Computing Graduate Certificate.

1. **Effective Date**

Fall 2022

1. **Justification –** *Please provide details as to why this change is necessary.*

This modification clarifies in the graduate bulletin existing departmental practice. It is well known in the Computer Science discipline that it is unlikely a post to require proficiency in all three core areas of CS studied in this MS degree (Theory, Systems and Algorithms). For example, theoreticians in CS are developing and practicing the Theory and Algorithms areas, while in the software industry the Algorithms and Systems areas are the most prevalent. In the hardware industry the Theory and Systems areas are the most practiced. This trend implies that nearly for any computer science related post (hardware or software oriented), only two out of three core areas studied in the MS program are really necessary to be mastered at the level of A grade. In this light, the departmental practice is consistent with this trend by also allowing a B grade in only one of the three core areas in the MS degree with major in Computer Science.

CS 6273 Quantum Computing gives students an opportunity to catch up with one emerging technological trend in computer science. It strengthens their careers in both academia and industry.

**Bulletin Changes**

|  |
| --- |
| **Instructions** |
| **Please visit and select the most recent version of the bulletin. Copy and paste all bulletin pages this proposal affects below. Please include a before (with changed areas highlighted) and after of all affected sections.**  **\*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.** |

Before

**Computer Science**

**Master of Science**

|  |  |
| --- | --- |
| **University Requirements:** |  |
| See Graduate Degree Policies for additional information (p. 47) |  |
| **Program Requirements:**  Minimum of eighteen hours of 6000 level Computer Science and approved Mathematics and/or Statistics coursework inclusive of thesis. Students completing the MS non-thesis option must pass a comprehensive exam in the last semester of study. | **Sem. Hrs.** |
| **Theory:**  CS 5133, Compiler **OR**  CS 5723, Automata Theory | 3 |
| **Systems (select one of the following):**  CS 5313, Computer Networks  CS 6213, Parallel Processing  CS 6243, Distributed Systems  CS 6253, Heterogeneous Computing | 3 |
| **Algorithms:**  CS 5713, Analysis of Algorithms | 3 |
| Computer Science Electives | 18 |
| Computer Science, Mathematics, and/or Statistics Electives,  *Subject to the prior approval of the Computer Science Curriculum Committee.* | 6 |
| **Sub-total** | **33** |
| **Total Required Hours:** | **33** |

*The bulletin can be accessed at https://www.astate.edu/a/registrar/students/bulletins*

178

After

|  |  |
| --- | --- |
| **University Requirements:** |  |
| See Graduate Degree Policies for additional information (p. 47) |  |
| **Program Requirements:**  Minimum of eighteen hours of 6000 level Computer Science and approved Mathematics and/or Statistics coursework inclusive of thesis. Students completing the MS non-thesis option must pass a comprehensive exam in the last semester of study unless they have earned at least two “A’s” and one “B” course grades from each of the three Core categories: Theory, Systems and Algorithms. | **Sem. Hrs.** |
| **Theory:**  CS 5133, Compiler **OR**  CS 5723, Automata Theory | 3 |
| **Systems (select one of the following):**  CS 5313, Computer Networks  CS 6213, Parallel Processing  CS 6243, Distributed Systems  CS 6253, Heterogeneous Computing | 3 |
| **Algorithms:**  CS 5713, Analysis of Algorithms | 3 |
| Computer Science Electives | 18 |
| Computer Science, Mathematics, and/or Statistics Electives,  *Subject to the prior approval of the Computer Science Curriculum Committee.* | 6 |
| **Sub-total** | **33** |
| **Total Required Hours:** | **33** |

Before

**Computer Science**

**Master of Science**

**Emphasis in Cyber Security**

|  |  |
| --- | --- |
| **University Requirements:** |  |
| See Graduate Degree Policies for additional information (p. 47) |  |
| **Program Requirements:**  Minimum of eighteen hours of 6000 level Computer Science and approved Mathematics and/or Statistics coursework inclusive of thesis. Students completing the MS non-thesis option must pass a comprehensive exam in the last semester of study. | **Sem. Hrs.** |
| **Theory:**  CS 5133, Compiler **OR**  CS 5723, Automata Theory | 3 |
| **Systems (select one of the following):**  CS 5313, Computer Networks  CS 6213, Parallel Processing  CS 6243, Distributed Systems  CS 6253, Heterogeneous Computing | 3 |
| **Algorithms:**  CS 5713, Analysis of Algorithms | 3 |
| **Sub-total** | **9** |
| **Emphasis Area (Cyber Security):** | **Sem. Hrs.** |
| **Core (select three of the following):**  CS 6123, Software Security  CS 6313, Data Security  CS 6323, Computer Security  CS 6333, Network and Internet Security | 9 |
| **Emphasis Elective (select one of the following):**  CS 6123, Software Security  CS 6343, Cloud Security  LAW 6033, Cyberlaw and E-Commerce | 3 |
| CS Electives | 6 |
| CS, MATH, and/or STAT Electives,  *Subject to the prior approval of the Computer Science Curriculum Committee.* | 6 |
| **Sub-total** | **24** |
| **Total Required Hours:** | **33** |

*The bulletin can be accessed at https://www.astate.edu/a/registrar/students/bulletins*

179

After

|  |  |
| --- | --- |
| **University Requirements:** |  |
| See Graduate Degree Policies for additional information (p. 47) |  |
| **Program Requirements:**  Minimum of eighteen hours of 6000 level Computer Science and approved Mathematics and/or Statistics coursework inclusive of thesis. Students completing the MS non-thesis option must pass a comprehensive exam in the last semester of study unless they have earned at least two “A’s” and one “B” course grades from each of the three Core categories: Theory, Systems and Algorithms. | **Sem. Hrs.** |
| **Theory:**  CS 5133, Compiler **OR**  CS 5723, Automata Theory | 3 |
| **Systems (select one of the following):**  CS 5313, Computer Networks  CS 6213, Parallel Processing  CS 6243, Distributed Systems  CS 6253, Heterogeneous Computing | 3 |
| **Algorithms:**  CS 5713, Analysis of Algorithms | 3 |
| **Sub-total** | **9** |
| **Emphasis Area (Cyber Security):** | **Sem. Hrs.** |
| **Core (select three of the following):**  CS 6123, Software Security  CS 6313, Data Security  CS 6323, Computer Security  CS 6333, Network and Internet Security | 9 |
| **Emphasis Elective (select one of the following):**  CS 6123, Software Security  CS 6343, Cloud Security  LAW 6033, Cyberlaw and E-Commerce | 3 |
| CS Electives | 6 |
| CS, MATH, and/or STAT Electives,  *Subject to the prior approval of the Computer Science Curriculum Committee.* | 6 |
| **Sub-total** | **24** |
| **Total Required Hours:** | **33** |

Before

**Computer Science**

**Master of Science**

**Emphasis in Data Science**

|  |  |
| --- | --- |
| **University Requirements:** |  |
| See Graduate Degree Policies for additional information (p. 47) |  |
| **Program Requirements:**  Minimum of eighteen hours of 6000 level Computer Science and approved Mathematics and/or Statistics coursework inclusive of thesis. Students completing the MS non-thesis option must pass a comprehensive exam in the last semester of study. | **Sem. Hrs.** |
| **Theory:**  CS 5133, Compiler **OR**  CS 5723, Automata Theory | 3 |
| **Systems (select one of the following):**  CS 5313, Computer Networks  CS 6213, Parallel Processing  CS 6243, Distributed Systems  CS 6253, Heterogeneous Computing | 3 |
| **Algorithms:**  CS 5713, Analysis of Algorithms | 3 |
| **Sub-total** | **9** |
| **Emphasis Area (Data Science):** | **Sem. Hrs.** |
| **Core (select three of the following):**  CS 5543, Database Systems  CS 5623, Fundamentals of Data Science  CS 6443, Machine Learning  CS 6253, Data Mining Techniques | 9 |
| **Emphasis Elective (select one of the following):**  CS 6443, Machine Learning  CS 6543, Advanced Database Systems  STAT 6433, Time Series Analysis  STAT 6643, Multivariate Analysis  STAT 6653, Data Analysis I: Regression Analysis  STAT 6663, Data Analysis II: Analysis of Variance | 3 |
| CS Electives | 6 |
| CS, MATH, and/or STAT Electives,  *Subject to the prior approval of the Computer Science Curriculum Committee.* | 6 |
| **Sub-total** | **24** |
| **Total Required Hours:** | **33** |

*The bulletin can be accessed at* [*https://www.astate.edu/a/registrar/students/bulletins*](https://www.astate.edu/a/registrar/students/bulletins)

180

After

|  |  |
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| **University Requirements:** |  |
| See Graduate Degree Policies for additional information (p. 47) |  |
| **Program Requirements:**  Minimum of eighteen hours of 6000 level Computer Science and approved Mathematics and/or Statistics coursework inclusive of thesis. Students completing the MS non-thesis option must pass a comprehensive exam in the last semester of study unless they have earned at least two “A’s” and one “B” course grades from each of the three Core categories: Theory, Systems and Algorithms. | **Sem. Hrs.** |
| **Theory:**  CS 5133, Compiler **OR**  CS 5723, Automata Theory | 3 |
| **Systems (select one of the following):**  CS 5313, Computer Networks  CS 6213, Parallel Processing  CS 6243, Distributed Systems  CS 6253, Heterogeneous Computing | 3 |
| **Algorithms:**  CS 5713, Analysis of Algorithms | 3 |
| **Sub-total** | **9** |
| **Emphasis Area (Data Science):** | **Sem. Hrs.** |
| **Core (select three of the following):**  CS 5543, Database Systems  CS 5623, Fundamentals of Data Science  CS 6443, Machine Learning  CS 6253, Data Mining Techniques | 9 |
| **Emphasis Elective (select one of the following):**  CS 6443, Machine Learning  CS 6543, Advanced Database Systems  STAT 6433, Time Series Analysis  STAT 6643, Multivariate Analysis  STAT 6653, Data Analysis I: Regression Analysis  STAT 6663, Data Analysis II: Analysis of Variance | 3 |
| CS Electives | 6 |
| CS, MATH, and/or STAT Electives,  *Subject to the prior approval of the Computer Science Curriculum Committee.* | 6 |
| **Sub-total** | **24** |
| **Total Required Hours:** | **33** |

Before

**Computer Science**

**Master of Science**

**Emphasis in High Performance Computing**

|  |  |
| --- | --- |
| **University Requirements:** |  |
| See Graduate Degree Policies for additional information (p. 47) |  |
| **Program Requirements:**  Minimum of eighteen hours of 6000 level Computer Science and approved Mathematics and/or Statistics coursework inclusive of thesis. Students completing the MS non-thesis option must pass a comprehensive exam in the last semester of study. | **Sem. Hrs.** |
| **Theory:**  CS 5133, Compiler **OR**  CS 5723, Automata Theory | 3 |
| **Systems:**  CS 5313, Computer Networks | 3 |
| **Algorithms:**  CS 5713, Analysis of Algorithms | 3 |
| **Sub-total** | **9** |
| **Emphasis Area (High Performance Computing):** | **Sem. Hrs.** |
| **Core (select three of the following):**  CS 6213, Parallel Processing  CS 6243, Distributed Systems  CS 6253, Heterogeneous Computing CS 6263, Cloud Computing | 9 |
| **Emphasis Elective (select one of the following):**  CS 5223, Unix Systems Programming  CS 6223, Advanced Computer Architecture  CS 6233, Operating System Design  CS 6263, Cloud Computing | 3 |
| CS Electives | 6 |
| CS, MATH, and/or STAT Electives,  *Subject to the prior approval of the Computer Science Curriculum Committee.* | 6 |
| **Sub-total** | **24** |
| **Total Required Hours:** | **33** |

*The bulletin can be accessed at* [*https://www.astate.edu/a/registrar/students/bulletins*](https://www.astate.edu/a/registrar/students/bulletins)

181

After

|  |  |
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| **University Requirements:** |  |
| See Graduate Degree Policies for additional information (p. 47) |  |
| **Program Requirements:**  Minimum of eighteen hours of 6000 level Computer Science and approved Mathematics and/or Statistics coursework inclusive of thesis. Students completing the MS non-thesis option must pass a comprehensive exam in the last semester of study unless they have earned at least two “A’s” and one “B” course grades from each of the three Core categories: Theory, Systems and Algorithms. | **Sem. Hrs.** |
| **Theory:**  CS 5133, Compiler **OR**  CS 5723, Automata Theory | 3 |
| **Systems (select one of the following):**  CS 5313, Computer Networks  CS 6213, Parallel Processing  CS 6243, Distributed Systems  CS 6253, Heterogeneous Computing | 3 |
| **Algorithms:**  CS 5713, Analysis of Algorithms | 3 |
| **Sub-total** | **9** |
| **Emphasis Area (High Performance Computing):** | **Sem. Hrs.** |
| **Core (select three of the following if not selected above):**  CS 6213, Parallel Processing  CS 6243, Distributed Systems  CS 6253, Heterogeneous Computing  CS 6263, Cloud Computing | 9 |
| **Emphasis Elective (select one of the following):**  CS 5223, Unix Systems Programming  CS 6223, Advanced Computer Architecture  CS 6233, Operating System Design  CS 6273, Quantum Computing | 3 |
| CS Electives | 6 |
| CS, MATH, and/or STAT Electives,  *Subject to the prior approval of the Computer Science Curriculum Committee.* | 6 |
| **Sub-total** | **24** |
| **Total Required Hours:** | **33** |

*2021-2022 Graduate Bulletin*

Page 186 Before:

**High Performance Computing**

**Graduate Certificate**

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| **University Requirements:** |  |
| See Graduate Degree Policies for additional information (p. 47) |  |
| **Program Requirements:** | **Sem. Hrs.** |
| CS 6213, Parallel Processing | 3 |
| CS 6253, Heterogeneous Computing | 3 |
| CS 6243, Distributed Systems | 3 |
| **Sub-total** | **9** |
| **Electives** | **Sem. Hrs.** |
| **Select six hours from of the following:**  CS 5223, Unix Systems Programming  CS 6223, Advanced Computer Architecture  CS 6233, Operating System Design  CS 6263, Cloud Computing | 6 |
| **Total Required Hours:** | **15** |

*2021-2022 Graduate Bulletin*

Page 186 After:

**High Performance Computing**

**Graduate Certificate**

|  |  |
| --- | --- |
| **University Requirements:** |  |
| See Graduate Degree Policies for additional information (p. 47) |  |
| **Program Requirements:** | **Sem. Hrs.** |
| CS 6213, Parallel Processing | 3 |
| CS 6253, Heterogeneous Computing | 3 |
| CS 6243, Distributed Systems | 3 |
| **Sub-total** | **9** |
| **Electives** | **Sem. Hrs.** |
| **Select six hours from of the following:**  CS 5223, Unix Systems Programming  CS 6223, Advanced Computer Architecture  CS 6233, Operating System Design  CS 6263, Cloud Computing  CS 6273, Quantum Computing | 6 |
| **Total Required Hours:** | **15** |

**Appendix A, 8-Semester Plan**

(**Referenced in #2** - **Undergraduate Proposals Only)**

*Instructions: Please identify new courses in italics*.

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| **Arkansas State University-Jonesboro**  **Degree:**  **Major:**  **Year:** | | | | | | | | |
| Students requiring developmental course work based on low entrance exam scores (ACT, SAT, ASSET, COMPASS) may not be able to complete this program of study in eight (8) semesters. Developmental courses do not count toward total degree hours. **Students having completed college level courses prior to enrollment will be assisted by their advisor in making appropriate substitutions. In most cases, general education courses may be interchanged between semesters.** A minimum of 45 hours of upper division credit (3000-4000 level) is required for this degree. | | | | | | | | |
| **Year 1** | | | |  | **Year 1** | | | |
| **Fall Semester** | | | |  | **Spring Semester** | | | |
| **Course No.** | **Course Name** | **Hrs** | **Gen Ed** |  | **Course No.** | **Course Name** | **Hrs** | **Gen Ed** |
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| **Year 2** | | | |  | **Year 2** | | | |
| **Fall Semester** | | | |  | **Spring Semester** | | | |
| **Course No.** | **Course Name** | **Hrs** | **Gen Ed** |  | **Course No.** | **Course Name** | **Hrs** | **Gen Ed** |
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| **Total Hours** |  |  |  |  | **Total Hours** |  |  |  |
| **Year 3** | | | |  | **Year 3** | | | |
| **Fall Semester** | | | |  | **Spring Semester** | | | |
| **Course No.** | **Course Name** | **Hrs** | **Gen Ed** |  | **Course No.** | **Course Name** | **Hrs** | **Gen Ed** |
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| **Year 4** | | | |  | **Year 4** | | | |
| **Fall Semester** | | | |  | **Spring Semester** | | | |
| **Course No.** | **Course Name** | **Hrs** | **Gen Ed** |  | **Course No.** | **Course Name** | **Hrs** | **Gen Ed** |
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| **Total Hours** |  |  |  |  | **Total Hours** |  |  |  |
| **Total Jr/Sr Hours \_\_\_ Total Degree Hours \_\_\_** | | | | | | | | |
| **Graduation Requirements:** | | | | | | | | |