Computer Science, M.S.C.S.

Curriculum in Masters of Science in Computer Science

A candidate for the M.S. degree in computer science must comply with the rules and regulations as outlined in the WVU Graduate Catalog and the specific requirements of the Statler College and the Lane Department of Computer Science and Electrical Engineering.

Program Requirements

All M.S. degree candidates are required to perform research and follow a planned program of study. The student’s research advisor, in conjunction with the student’s Advising and Examining Committee (AEC) will be responsible for determining the plan of study appropriate to the student’s needs. The underlying principle of the planned program is to provide the students with the necessary support to complete their degree and prepare them for their career.

Curriculum Requirements

A minimum cumulative GPA of 3.0 is required

Course Requirements *
No more than 9 credit hours may be at the 400 level.
CS 796 Graduate Seminar 1

Area of Concentration
Complete one Area of Concentration in any area:
 One Core course
 Two Elective courses
Complete 6 additional credit hours core courses from the other two areas that are not the area of concentration. 6

Elective Courses
Choose 9 additional credit hours from the courses listed in any CS area of concentration

Complete 1 of the following options: 7-9

Thesis Option - 7 hours
CS 796 Graduate Seminar (1 hour)
CS 697 Research (6 hours)
Thesis
Final Oral or Written Examination

Problem Report Option - 9 hours
Complete a minimum 6 additional hours of coursework, at least 3 hours of which must be from the completed area of concentration.
CS 697 Research (3 hours)
Formal written report or professional report/paper
Final Oral or Written Examination

Coursework Option - 9 hours
Complete a minimum of 9 additional hours of coursework, at least 6 hours of which must be from the completed area of concentration.

Total Hours 32-34

* Students who do not hold a baccalaureate degree in computer science are required to take a set of undergraduate computer science courses above and beyond the minimum coursework requirements.

Areas of Concentration

COMPUTER SYSTEMS

Core Courses
CPE 553 Advanced Networking Concepts
CPE 670 Switching Circuit Theory 1

Elective Courses
CPE 435 Computer Incident Response
CPE 520 Application of Neural Networks
CPE 521 Applied Fuzzy Logic
SOFTWARE/KNOWLEDGE ENGINEERING

Core Courses
CPE 684 Advanced Real-Time Systems
CS 573 Advanced Data Mining
CS 630 Empirical Methods in Software Engineering and Computer Science
CS 677 Pattern Recognition

Elective Courses
BIOM 693 Special Topics (Advanced Biometrics)
CS 533 Developing Portable Software
CS 558 Multimedia Systems
CS 572 Advanced Artificial Intelligence Techniques
CS 665 Computer System Security
CS 674 Computational Photography
CS 676 Machine Learning
CS 678 Computer Vision
CS 757 Distributed Systems and Algorithms
CS 793 Special Topics (Search-based Software Engineering, Software Reliability)
EE 565 Advanced Image Processing
SENG 530 Software Verification and Validation

THEORY OF COMPUTING

Core Courses
CS 510 Formal Specification of Language
CS 520 Advanced Analysis of Algorithms
CS 525 Computational Complexity

Elective Courses
CS 410 Compiler Construction
CS 420 Design of Algorithms
CS 422 Automata Theory
CS 426 Discrete Mathematics 2
CS 593 Special Topics (Network Optimization)
CS 623 String Algorithms
CS 693 Special Topics (Fixed Parameter Algorithms)
CS 677 Pattern Recognition
CS 726 Algorithmic Graph Theory
CS 727 Information Dissemination
CS 793 Special Topics (Approximation Algorithms)
CS 793 Special Topics (Randomized Algorithms)

Final Examination

M.S. students following the thesis or problem report option must prepare a written research proposal. The proposal must be approved by the student’s AEC at least one semester prior to the final oral examination.
All students following the thesis or problem report option are required to pass a final oral or written examination, administered by their AEC, covering the thesis or problem report and/or related course material.

All master’s students must defend their thesis or problem report at an oral exam, attended by all members of the committee.

A student who fails the research defense may repeat the defense at most once, at a time determined by the AEC but not necessarily during the same semester.

**Suggested Plan of Study**

The plan below illustrates the Thesis Option. It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical M.S.C.S degree program that completes degree requirements in one and half years is as follows. Those students who lack course prerequisites may require more than three semesters of full-time study to complete the degree. Students with research assistantships may also require more than three semesters to complete the degree.

### First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of Concentration 1 Core Course</td>
<td>3</td>
<td>Area of Concentration 1 Elective Course</td>
<td>3</td>
</tr>
<tr>
<td>Area of Concentration 1 Elective Course</td>
<td>3</td>
<td>Area of Concentration 2 Core Course</td>
<td>3</td>
</tr>
<tr>
<td>Elective Course</td>
<td>3</td>
<td>Elective Course</td>
<td>3</td>
</tr>
<tr>
<td>CS 796</td>
<td>1</td>
<td>CS 796</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10</strong></td>
<td><strong>Total</strong></td>
<td><strong>10</strong></td>
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### Second Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of Concentration 3 Core Course</td>
<td>3</td>
</tr>
<tr>
<td>Elective Course</td>
<td>3</td>
</tr>
<tr>
<td>CS 697</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

Total credit hours: 32

**Major Learning Outcomes**

**COMPUTER SCIENCE**

It is our goal that in the first five years after graduation our students will:

1. Achieve success and proficiency in the Computer Science profession.
2. Be recognized as leaders.
3. Contribute to the well-being of society.

**Areas of Emphasis Offered**

- Computational Data Science
- Cybersecurity

**AREA OF EMPHASIS IN COMPUTATIONAL DATA SCIENCE**

<table>
<thead>
<tr>
<th>Data Science Core *</th>
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</thead>
<tbody>
<tr>
<td>CS 560 Big Data Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Select one of the following:</td>
<td>3</td>
</tr>
<tr>
<td>CS 573 Advanced Data Mining</td>
<td></td>
</tr>
<tr>
<td>CS 676 Machine Learning</td>
<td></td>
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<tr>
<td>CS 677 Pattern Recognition</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Science Electives ** *</th>
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<tbody>
<tr>
<td>Cyber-Security:</td>
<td></td>
</tr>
<tr>
<td>CS 568 Computer Network Forensics</td>
<td></td>
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<tr>
<td>CS 569 Cybersecurity and Big Data Analytics</td>
<td></td>
</tr>
<tr>
<td>Theoretical Foundations:</td>
<td></td>
</tr>
<tr>
<td>CS 520 Advanced Analysis of Algorithms</td>
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</tbody>
</table>
Students pursuing this area of emphasis must successfully complete a total of 12 hours in identified data science courses. To fulfill the requirements for the Area of Emphasis in Computational Data Science graduate students must successfully complete the following set of courses: two courses from the Data Science core, one of which must be CS 560 – Big Data Engineering, plus one other course from the Data Science core; and two courses (6 credit hours) from the Data Science electives listed in the accompanying table. Students are encouraged but not required to choose Data Science elective courses from the same topic area. This is intended to foster a more concentrated focus in the student’s data science expertise. Students may also, if they choose, take one of the Data Science core courses, not already taken, as a data science elective.

Students may choose to take one optional elective course from a department other than the Lane Department of Computer Science and Electrical Engineering. Courses outside of the Lane Department to satisfy the elective requirements of this area of emphasis must be approved by the Lane Department’s Computational Data Science coordinator.

**AREA OF EMPHASIS IN CYBERSECURITY**

A 3.0 GPA is required in AOE coursework.

### Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPE 536</td>
<td>Computer Data Forensics</td>
<td>3</td>
</tr>
<tr>
<td>CPE 568</td>
<td>Computer Network Forensics</td>
<td>3</td>
</tr>
<tr>
<td>CS 539</td>
<td>Computer Forensics and the Law</td>
<td>3</td>
</tr>
</tbody>
</table>

### Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPE 538</td>
<td>Intro Computer Security Management</td>
</tr>
<tr>
<td>CS 569</td>
<td>Cybersecurity and Big Data Analytics</td>
</tr>
</tbody>
</table>

Total Hours: 12