Software Engineering, M.S.S.E.

Degrees Offered

- Masters of Science, Software Engineering (M.S.S.E.)

Program Description

The Lane Department of Computer Science and Electrical Engineering offers the professionally oriented and applied Masters of Science in Software Engineering (M.S.S.E.) degree program, as well as a Graduate Certificate in Software Engineering. The M.S.S.E. provides graduate educational opportunities to working professionals. The M.S.S.E. degree is a unique fully-online program that provides graduate level software engineering expertise to individuals who are currently working in software engineering or the information technology industry. The program aspires to serve full-time software engineering professions with a background in computer science or similar fields seeking an applied masters program who want the flexibility of an online format.

Under the coursework-only option, students will complete their degree requirements with five core courses and five advanced elective courses that deepen their understanding of aspects of software engineering relevant to their careers. Problem Report and Thesis Options are also available.

Program Educational Objectives & Outcomes

The objective of the program is to produce graduates who have the knowledge, skills, and attitudes that will ensure success in professional positions in business, industry, research, or governmental service.

After completing five core courses, students will achieve the following outcomes.

Proficiency in:

- Software Project Management.
- Software Analysis and Design.
- Object-Oriented Design of Software.
- Software Verification and Validation.
- Software Evolution.

Admissions to the M.S.S.E. Program

Students seeking admission to the M.S.S.E. program must satisfy the following requirements to be considered. All students must fulfill all items required in Category A or Category B:

- Category A Admission Requirements
  - Submit official transcripts showing degree completion of a Bachelor degree in Computer Science, Computer Engineering, Software Engineering, or a closely related field from an accredited University, with a minimum cumulative grade point average of 3.0 (on a 4-point scale) or better.
  - Submit satisfactory scores in quantitative reasoning for the GRE General Test OR submit a resume reflecting one year of software engineering experience in any industry with no GRE required.
  - Submit a personal statement
  - Submit a resume
  - Submit three academic or work-related references.
  - International applicants must meet the WVU requirement of English language proficiency (https://graduateadmissions.wvu.edu/how-to-apply/apply-for-2022-2023/international-graduate-applicant/).

- Category B Admission Requirements
  - Submit official transcripts showing degree completion of a Bachelor degree in any field of study from an accredited University with a minimum cumulative grade point average of 3.0 (on a 4-point scale) or better.
  - Submit a personal statement
  - Submit a resume
  - Submit 3 letters of reference that demonstrate 3 years or more of software engineering experience in any industry.
  - No GRE is required.
  - Upon entry into the program, complete SENG 505 Programming Applications with JAVA with a letter grade of ‘B’ or above. Note: the credit earned for the SENG 505 course does not apply toward the required hours for the MSSE Degree.
  - International applicants must meet the WVU requirement of English language proficiency (https://graduateadmissions.wvu.edu/how-to-apply/apply-for-2022-2023/international-graduate-applicant/).
Admission Requirements 2023-2024
The Admission Requirements above will be the same for the 2023-2024 Academic Year.

Major Code 3081

Curriculum in Master of Science in Software Engineering
A candidate for the M.S. degree in software engineering 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 follow a planned program of study. The student's faculty 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 student 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

Plan of Study
The following five core courses are required.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>SENG 510</td>
<td>Software Project Management</td>
<td>3</td>
</tr>
<tr>
<td>SENG 520</td>
<td>Software Analysis and Design</td>
<td>3</td>
</tr>
<tr>
<td>SENG 530</td>
<td>Software Verification and Validation</td>
<td>3</td>
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<tr>
<td>SENG 540</td>
<td>Software Evolution</td>
<td>3</td>
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<tr>
<td>SENG 550</td>
<td>Object Oriented Design</td>
<td>3</td>
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Advanced Elective Course **** 9
Select from the following:

- CPE 538 Intro Computer Security Management
- CPE 553 Advanced Networking Concepts
- CS 533 Developing Portable Software
- IENG 474 Technology Entrepreneurship
- SENG 560 Software Reuse
- SENG 561 Agile Software Development
- SENG 564 Software Engineering of Mobile Applications
- SENG 581 Quality Software Process Management
- SENG 582 Enterprise Architecture Framework
- SENG 670 Data Analytics with Applications in Software Engineering
- SENG 695 Independent Study (Experiential Learning)
- SENG 650 Cloud Computing for the Internet of Things
- STAT 511 Statistical Methods 1
- STAT 521 Statistical Analysis System Programming
- STAT 522 Advanced Statistical Analysis System Programming (upon request to Advisor)

Any SENG Courses 510-695 may be taken as an advanced elective.

Complete 1 of the following options: 6

**Thesis Option - 6 hours**

- SENG 697 Research (6 hours)
- Final Oral or Written Examination

**Problem Report Option - 6 hours**

- Complete 3 additional hours of advanced elective coursework
- SENG 697 Research (3 hours)
- Final Oral or Written Examination

**Coursework Option - 6 hours**
Complete 6 additional hours of advanced electives coursework

<table>
<thead>
<tr>
<th>Hours</th>
<th>Total Hours</th>
<th>30</th>
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* SENG 505 is only offered as a Preparatory Course, required only for specified Provisional Graduate Student and no credit can be earned toward the degree or certificate.

** A maximum of 12 semester credit hours taken elsewhere may be transferred into the program.

*** No more than 9 semester credit hours of 400-level (senior undergraduate) LCSEE department courses (or equivalent courses transferred from outside the university) may be included in your program if they were not counted for another degree.

**** All of these options noted require approval by the software engineering curriculum committee.

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. These students are required to pass a final oral examination, administered by their AEC, covering the thesis or problem report.

Suggested Plan of Study

The plan below illustrates the Coursework 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.S.E degree program that completes degree requirements in two years is as follows.

First Year

<table>
<thead>
<tr>
<th>Fall Hours</th>
<th>Spring Hours</th>
<th>Summer Hours</th>
<th>Total Hours</th>
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</thead>
<tbody>
<tr>
<td>SENG 520</td>
<td>3 SENG 510</td>
<td>3 SENG 540</td>
<td>6</td>
</tr>
<tr>
<td>SENG 550</td>
<td>3 SENG 530</td>
<td>3 Adv. Elective Course</td>
<td>6</td>
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<td>6</td>
<td>6</td>
<td>30</td>
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Second Year

<table>
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<tr>
<th>Fall Hours</th>
<th>Spring Hours</th>
<th>Total Hours</th>
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<td>Adv Elective Course</td>
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Major Learning Outcomes

SOFTWARE ENGINEERING

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

1. Apply software engineering practices to solve complex problems by analyzing and assessing needs and implementing improvements.
2. Achieve success and proficiency in the Software Engineering profession by making significant contributions to technology advancements.
4. Advance as a team member or lead engaged in the Software Engineering discipline.

COURSES

SENG 505. Programming Applications with Java. 3 Hours.
PR: Consent. This course serves as an introduction to developing application software. It covers solving problems using the Java programming language. Topics include problem-solving, fundamentals of programming, basic algorithms and data structures, data organization, defensive programming, relational databases and creating database applications.

SENG 510. Software Project Management. 3 Hours.
Techniques and tools for managing the software development process for large development projects.

SENG 520. Software Analysis and Design. 3 Hours.
Defining software requirements and an introduction to the principles and concepts relevant to the design of large programs and software systems.
SENG 530. Software Verification and Validation. 3 Hours.
Tools and techniques for applied verification and validation of computer software including requirements, design, and code relevant to several
development lifecycle models.

SENG 540. Software Evolution. 3 Hours.
Software process and the Capability Maturity Model (CMM), software maintenance and evolution, program understanding, reengineering, software
configuration management, and software tools related to these issues.

SENG 550. Object Oriented Design. 3 Hours.
Highlights contemporary design and analysis techniques with a strong emphasis on the Unified Modeling Language (UML). The class focuses on
problem space analysis utilizing object oriented techniques to produce real world design solutions in UML.

SENG 560. Software Reuse. 3 Hours.
PR: SENG 550 or consent. A detailed study of the business, organizational, and technical implications of large-scale software reuse in modern
environments. Architecture, design for reuse, domain engineering, model-driven development, frameworks, library design, reuse tools, and design
patterns.

SENG 561. Agile Software Development. 3 Hours.
PR: SENG 550 or consent. Techniques and methodologies of agile software engineering; development team roles, product backlog, sprint planning,
sprint execution, test-driven development, sprint retrospective, development tools and environments. Emphasis on successfully managing agile projects
in geographically dispersed work environments.

SENG 564. Software Engineering of Mobile Applications. 3 Hours.
PR: SENG 550 or consent. Software engineering of mobile applications and real-world development of mobile technology. Architecture of a simple
mobile application. Industry leaders of mobile software engineering. Mobile economics. Mobile software engineering security practices. Mobile enterprise
architectures.

SENG 581. Quality Software Process Management. 3 Hours.
PR: SENG 510 or consent. Evaluate quality theories and practices; research quality history, principles and techniques; and apply software engineering
quality management methods and standards to develop software quality model artifacts in an enterprise environment.

SENG 582. Enterprise Architecture Framework. 3 Hours.
PR: SENG 520 or Consent. Study of architecture frameworks used in government and business to design holistic advanced computer systems.
Application of frameworks to the enterprise processes, technologies, and people to achieve the enterprise mission and objectives.

SENG 585. Software Engineering Economics. 3 Hours.
PR: SENG 510 or instructor consent. The software engineering economics fundamentals to real-world software economic problems addressed to
include software life cycle economics and concepts of risk and uncertainty to software development projects. Application of best practices economic
analysis methods for software life-cycle economics, including portfolio and product line management, investment decisions, and earned value
management.

SENG 591. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

SENG 610. Strategies for Managing Software Projects. 3 Hours.
PR: SENG 510. Presents best practices for managing software development projects. Addresses leadership, teamwork, issues in modern system
development, complexity and its influence on projects, estimating project effort and duration, development of software-intensive systems and systems-of-systems.

SENG 630. Requirements Engineering. 3 Hours.
PR: SENG 520 or consent. Study of the requirements engineering phase of the software development process. Techniques for building strong
requirements, including management, analysis, risk mitigation, validation, customer signoff, and change control.

SENG 650. Cloud Computing for the Internet of Things. 3 Hours.
PR: SENG 550 or consent. Investigation of cloud computing techniques and architectures for the Internet of Things (IoT). Basic concepts and current
practices of cloud computing and IoT. Topics include cloud computing models, technologies, security, and privacy. Exploration of example applications
and patterns of IoT.

SENG 670. Data Analytics with Applications in Software Engineering. 3 Hours.
PR: SENG 520 and STAT 215 or consent. Foundation of data science, with focus on applications in software engineering. Different empirical methods
such as surveys, case studies, and experiments. Threats to validity. Methods for data preparation. Statistics for data understanding and assessment.
Commonly used supervised and unsupervised machine learning algorithms.

SENG 691. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

SENG 695. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.
SENG 697. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).