

## COLLEGE OF SCIENCE AND ENGINEERING

*Michael J. Quinn, PhD, Dean*

*Jean Jacoby, PhD, Associate Dean*

*Mara Rempe, PhD, Associate Dean*

### Degree Offered

Master of Software Engineering (MSE)

### Objectives

The objective of the MSE program is to provide software development professionals with a sound educational basis for their work, and the opportunity to broaden and hone their software development skills.

### Admission Requirements

Applications for the Master of Software Engineering program are considered for every quarter. All application materials should be sent to Graduate Admissions by the stated deadline for that quarter. Late applicants can only be considered as non-matriculating students and on a space available basis. The following documents are required for consideration:

- Completed Application for Graduate Admission and non-refundable application fee (waived for Seattle University alumni)
- Evidence of four-year equivalent bachelor's degree in computer science or a related discipline from a regionally accredited institution
- Minimum GPA of 3.00 calculated from official transcripts of all post-secondary educational institutions attended in the last 90 quarter/60 semester credits of your bachelor's degree, including any transfer credits earned during this time, and any post-baccalaureate course work
- Résumé reflecting two years of experience in software development or maintenance
- Completed Master of Software Engineering Applicant Information form noting working knowledge of at least one programming language, such as C++, Java or C#
- Professional autobiography
- Two professional recommendations using MSE recommendation forms
- Official Graduate Record Exam (GRE) General Test results from within the past five years. The Subject Test in Computer Science is optional.
- If English is not the applicant's native language, official English proficiency scores meeting the university's entrance requirements are necessary. See policy 2008-01 in Admissions Policies for details.

# Software Engineering

*Richard LeBlanc, PhD, Graduate Program Director*

## Degree Offered

Master of Software Engineering (MSE)

## Master of Software Engineering

The MSE program at Seattle University is designed for working professionals. Our classes are typically offered in the evenings. The program builds on the computing experience of its students by providing course work in a variety of software engineering and computer science topics, with an emphasis on teamwork and a disciplined approach to software development. We offer a balanced curriculum of technical and managerial courses, with a choice of elective streams to address areas of personal interest. The principles and techniques learned throughout the course work are integrated into a year-long software project as the capstone experience.

Seattle University has long been a leader in software engineering education. It established its pioneering MSE program in 1979, and awarded the world's first MSE degree in 1982.

Our graduate faculty has extensive industrial experience as well as strong academic credentials. Our curriculum has been shaped by close contacts with local industry, ensuring that courses are relevant to the workplace and that projects are tailored to the professional needs of our students.

## Degree Requirements – Master of Software Engineering

Minimum requirements for the degree are 45 graduate credits. These include 27 credits of required courses, 9 credits of elective courses, and 9 credits of software engineering project. Core courses in computing (CSSE 501 and 503) may be waived for students passing a placement exam, and replaced by additional electives. A maximum of 3 credits of 59x courses may be taken toward the MSE degree without department approval. A maximum of 12 credits taken in non-matriculated status may be applied to this program. Transfer credit regulations are described earlier in this *Bulletin*. All degree requirements must be completed within six years after course work has begun.

### I. Computing Concepts

6 CSSE credits (required unless waived):

CSSE 501	Object-Oriented Concepts .....	3
CSSE 503	Data Structures and Algorithms .....	3

### II. Software Design and Development

15 CSSE credits required:

CSSE 522	Software Modeling .....	3
CSSE 523	Human-Computer Interaction.....	3
CSSE 524	Software Construction .....	3
CSSE 525	Data Modeling.....	3
CSSE 532	Software Architecture .....	3

**III. Project Management**

6 CSSE credits required:

CSSE 520	Software Requirements .....	3
CSSE 526	Software Project Planning .....	3

**IV. Required Project Courses**

9 CSSE credits, including:

CSSE 585	Software Engineering Project I .....	3
CSSE 586	Software Engineering Project II .....	3
CSSE 587	Software Engineering Project III .....	3

**V. Program Electives**

9 Elective credits ..... 9

Can be chosen from the following categories or from any other graduate courses in software engineering. Students may take up to 6 credits of graduate courses from other programs with department approval.

**Computing Concepts**

CSSE 543	Applied Formal Methods
CSSE 553	Artificial Intelligence

**Software Design and Development**

CSSE 534	Software Testing
CSSE 550	Distributed Computing
CSSE 551	Embedded Systems
CSSE 572	Software Security

**Project Management**

CSSE 530	Software Economics
CSSE 536	Software Project Management
CSSE 537	Software Quality Assurance

**Minimum credits required for degree .....45****Elective Courses**

Unless otherwise indicated at the time of offering, any regularly scheduled graduate course in software engineering other than the core courses and the project courses may be used to satisfy the elective course requirement. Students may also take a maximum of three credits of Special Topics (CSSE 591, 592, 593), Software Engineering Seminar (CSSE 594), Independent Study (CSSE 596, 597, 598), or Internship (CSSE 595) for elective credit, without department approval. With departmental approval, up to six credits of graduate-level courses from other departments, especially selected graduate courses from the Albers School of Business at Seattle University are acceptable for elective credit.

## Software Engineering Project

Satisfactory performance in the three-quarter software engineering project sequence (CSSE 585, CSSE 586, and CSSE 587) is required of all MSE students. Students are grouped into teams that complete a significant software project. Students who are not full-time are expected to take only the project sequence in their final year. Students are encouraged not to begin the software engineering project sequence unless CSSE 587 will be their final course in the program. All participants in the project sequence will be required to sign a Seattle University intellectual property (IP) and computer project room agreement, and may be required to sign an IP agreement with the project sponsor.

## Sample Program Schedules

### Three-year track with CSSE 501 and 503 required:

	Fall	Winter	Spring
Year 1	CSSE 501 CSSE 520	CSSE 503 CSSE 522	CSSE 523 elective
Year 2	CSSE 526 CSSE 532	CSSE 525 elective	CSSE 524 elective
Year 3	CSSE 585	CSSE 586	CSSE 587

### Three-year track with CSSE 501 and 503 waived:

	Fall	Winter	Spring
Year 1	CSSE 520 CSSE 526	CSSE 522 CSSE 525	CSSE 523 CSSE 524
Year 2	CSSE 532 elective	elective elective	elective elective
Year 3	CSSE 585	CSSE 586	CSSE 587

### Two-year track for full-time students:

	Fall	Winter	Spring
Year 1	CSSE 501 CSSE 520 CSSE 526	CSSE 503 CSSE 522 CSSE 525	CSSE 523 elective CSSE 524
Year 2*	CSSE 585 CSSE 532	CSSE 586 elective	CSSE 587 elective

\*International students may need to take an additional three credits each term to be eligible for student visa status.

## Graduate Courses

- CSSE 501      Object-Oriented Concepts ..... 3**  
Introduction to principles and techniques of object-oriented development. In-depth understanding of object-oriented concepts, including abstraction, encapsulation, inheritance, subtypes, subclasses, polymorphism and support for re-use.
- CSSE 503      Data Structures and Algorithms ..... 3**  
Basic strategies of algorithm design: top-down design, divide and conquer, average and worst-case complexity, asymptotic costs, simple recurrence relations. Choice of appropriate data structures such as arrays, stacks, queues, trees, heaps, graphs, hash tables, etc. Applications to sorting and searching. Introduction to discrete optimization algorithm: dynamic programming, greedy algorithms. Prerequisite: CSSE 501.
- CSSE 520      Software Requirements ..... 3**  
Definition of types of requirements; elicitation processes; analysis techniques; documentation methods; validation methods, quality and security issues.
- CSSE 522      Software Modeling ..... 3**  
Design principles; design approaches; use of architectures and frameworks; applying design patterns; documentation standards; graphical design techniques; quality analysis and security issues. Prerequisite: CSSE 501.
- CSSE 523      Human-Computer Interaction ..... 3**  
Relationship of user interface design to human-computer interaction. Interface quality and methods of evaluation; dimensions of interface variability; dialogue genre, tools and techniques; user-centered design, task analysis and implementation.
- CSSE 524      Software Construction ..... 3**  
High-quality life cycle practices; key programming decisions; design practices; classes; defensive programming; using variables and types; collaborative work; developer testing; re-factoring, code-tuning and system considerations; layout; style and documentation. Prerequisites: CSSE 522 and 525.
- CSSE 525      Data Modeling ..... 3**  
Data design and modeling for transactional and analytical systems; the use of relational and object databases; database security issues; database performance issues; and data access: Pre or Co-requisite: CSSE 503.
- CSSE 526      Software Project Planning ..... 3**  
Initiation and scope definition; software project planning process; deliverables; effort, schedule and cost estimation; resource allocation; risk management; quality management; and management; project planning and estimating tools.
- CSSE 530      Software Economics ..... 3**  
Business decision-making process; time value of money; comparing proposals; for-profit decisions; not-for-profit decisions; estimation; risk and uncertainty; buy vs. build decisions, outsourcing costs and return. Prerequisites: CSSE 520 and CSSE 526.
- CSSE 532      Software Architecture ..... 3**  
Concepts and methodologies for state-of-the-art methods in software architectures, including domain-specific software architectures (DSSA), architectural styles, architecture description languages (ADL), component-based software development, software connectors, dynamism in architectures. Evaluation of software architectures and design alternatives based on the non-functional properties, architecture-based testing and analysis, and current trends in software architecture. Prerequisite: CSSE 522.

- CSSE 534 Software Testing ..... 3**  
Test levels (unit, integration and system); test objectives testing techniques, measures and process (planning, test case generation and defect tracking). Prerequisite: CSSE 524.
- CSSE 536 Software Project Management ..... 3**  
Management of software projects (implementation of plans, supplier and subcontractor contract management, implementation of measurement process, monitoring and controlling process, and reporting); review and evaluation (determining satisfaction of requirements, reviewing and evaluating performance); project closure; software engineering measurement; process improvement. Prerequisite: CSSE 526.
- CSSE 537 Software Quality Assurance..... 3**  
Software engineering process (implementation and change, definition, and measurement); software quality (fundamentals, process and practical considerations); Capability Maturity Model (CMM) for software. Evaluate current projects. Prerequisites: CSSE 520 and CSSE 526.
- CSSE 543 Applied Formal Methods ..... 3**  
Formal techniques for building reliable systems. Use of abstractions for concisely and precisely defining system behavior. Formal logic and proof techniques for verifying the correctness of programs. Hierarchies of abstractions, state transition models, Petri Nets, communicating processes. Operational and definitional specification languages. Prerequisite: CSSE 503.
- CSSE 550 Distributed Computing ..... 3**  
Design and analysis of distributed systems, distributed objects, middleware, quality of service in distributed systems and emerging topics in distributed computing. Prerequisite: CSSE 522.
- CSSE 551 Embedded Systems..... 3**  
Methods, techniques, and tools for design, analysis, and development of embedded systems; real-time concerns; performance, distribution, dynamism, and mobility concerns. Prerequisite: CSSE 522.
- CSSE 553 Artificial Intelligence ..... 3**  
Survey of artificial intelligence as it applies to software engineering. Acquisition and representation of knowledge. Search strategies. Selected applications, such as natural language processing, image recognition, planning, neural nets, and expert systems. Prerequisite: CSSE 503.
- CSSE 572 Software Security ..... 3**  
Introduction to software dependability, software security vs. security systems, security concerns in various phases of software development life cycle, risk management framework and threat modeling, security analysis (worms, viruses, physical leaks, root kits, Trojans, etc.), common exploits, legal and ethical issues and emerging topics in software security. Prerequisite: CSSE 522.
- CSSE 591-593 Special Topics..... 1 to 3**  
May include such topics as artificial intelligence, data privacy, embedded systems, ethics of computing, programming languages, real-time systems, software metrics, and other software engineering topics. A maximum of three credits of 59x courses may be taken toward the MSE degree without department approval. Prerequisite: instructor permission.
- CSSE 594 Software Engineering Seminar ..... 1 to 3**  
Examination of advanced current topics and issues in software engineering using a seminar approach. Course may be taken up to three times. A maximum of three credits of 59x courses may be taken toward the MSE degree without department approval. Prerequisite: instructor permission.

**CSSE 595 Internship..... 1 to 3**

By permission only. Supervised practical training combined with academic studies in which students apply and develop their software engineering knowledge and skills working for a business or non-profit institution. Students are required to conduct related academic studies under the supervision of a faculty advisor. A maximum of three credits of 59x courses may be taken toward the MSE degree without department approval.

**CSSE 596-598 Independent Study ..... 1 to 3**

Independent research and in-depth study of topics under the supervision of a faculty advisor. A maximum of three credits of 59x courses may be taken toward the MSE degree without department approval. Prerequisite: instructor permission.

**NOTE:** Up to six credits from other graduate programs, may be taken as MSE electives with departmental approval. Approved MBA courses include such topics as leadership, entrepreneurship, high tech marketing, management of change, and business ethics.

### Required Project Courses

**CSSE 585 Software Engineering Project 1..... 3****CSSE 586 Software Engineering Project 2..... 3****CSSE 587 Software Engineering Project 3..... 3**

Three-quarter sequence in which students are grouped into teams, and each team completes a year-long software project. The sequence begins in the fall and ends spring quarter. Students wishing to take other courses concurrently with CSSE 587 must obtain departmental approval. Prerequisites to CSSE 585: completion of core courses and departmental approval. Prerequisites to CSSE 586: successful completion of CSSE 585 and departmental approval. Prerequisites to CSSE 587: successful completion of CSSE 586 and departmental approval. All participants in the Project sequence will be required to sign a Seattle University intellectual property (IP) and computer project room agreement, and may be required to sign an IP agreement with the Project Sponsor.