SOFTWARE ENGINEERING (SWE)

200 Level Courses
SWE 205: Software Usability Analysis and Design. 3 credits.
Principles of user interface design. Concepts for objectively and quantitatively assessing the usability of software user interfaces. Outcomes include knowledge of quantitative engineering principles for designing usable software interfaces and an understanding that usability is more important than efficiency for almost all modern software projects, and often the primary factor that leads to product success. Major topics include cognitive models for human perceptions and needs, which are used as a basis for analytical and critical thinking about user interfaces; specific engineering principles for designing usable menus, forms, command languages, web sites, graphical user interfaces and web-based user interfaces. Assessments will include written analytical evaluations of existing user interfaces, exams, and HTML-based design projects. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). Limited to two attempts.

Registration Restrictions:
Required Prerequisites: (ENGH 101C or 101XS) or (ENGH 100C or 100XS).
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students with the terminated from CEC major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

300 Level Courses
SWE 301: Internship Preparation. 0 credits.
Preparation for Internship Educational Experience. Intended for, but not limited to, students planning internships in the Applied Computer Science Software Engineering Program. Internship employment opportunities. Basic interview skills. Techniques for applying academic knowledge to practical software development. Techniques for extracting knowledge from practical experience. Peer presentation from students who have completed internships. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). Limited to two attempts.

Recommended Prerequisite: Limited to ACS or CS majors with junior standing or permission of instructor.

Registration Restrictions:
Students with the terminated from CEC major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Satisfactory/No Credit scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 321: Software Engineering. 3 credits.
An introduction to concepts, methods, and tools for the creation of large-scale software systems. Methods, tools, notations, and validation techniques to analyze, specify, prototype, and maintain software requirements. Introduction to object-oriented requirements modeling, including use of case modeling, static modeling, and dynamic modeling using the Unified Modeling Language (UML) notation. Concepts and methods for the design of large-scale software systems. Fundamental design concepts and design notations are introduced. A study of object-oriented analysis and design modeling using the UML notation. Students participate in a group project on software requirements, specification, and object-oriented software design. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). Limited to two attempts. Equivalent to CS 321.

Registration Restrictions:
Required Prerequisites: ((ENGH 302C or 302XS) or (HNRS 110C or 110XS)) and (HNRS 122C, 122XS, 130C, 130XS, 131C, 131XS, 230C, 240C or 240XS) and (CS 310C or 310XS).
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Enrollment is limited to students with a major in Applied Computer Science, Computer Science or Systems Engineering.
Enrollment is limited to students with a minor in Computer Science or Software Engineering.

Enrollment limited to students in a Bachelor of Science or Post-Baccalaureate Certificate degrees.

Students with the terminated from CEC major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 332: Object-Oriented Software Design and Implementation. 3 credits.
In-depth study of software design and implementation using a modern, object-oriented language with support for graphical user interfaces and complex data structures. Topics covered are specifications, design patterns, and abstraction techniques, including typing, access control, inheritance, and polymorphism. Students will learn the proper engineering use of techniques such as information hiding, classes, objects, inheritance, exception handling, event-based systems, and concurrency. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). Limited to two attempts. Equivalent to CS 332.

Registration Restrictions:
Required Prerequisites: (CS 310C or 310XS) and (MATH 125C or 125XS).
C Requires minimum grade of C.
XS Requires minimum grade of XS.

Students with the terminated from CEC major attribute may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

400 Level Courses
SWE 401: Internship Reflection. 1 credit.
Reflection on Internship Educational Experience. Intended for, but not limited to, students completing internships in the Applied Computer
Science Software Engineering Program. Analysis of techniques for applying academic knowledge to practical software development. Analysis of techniques for extracting knowledge from practical experience. Student presentations summarizing internships relating them to academic program goals. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). Limited to two attempts.

**Recommended Prerequisite:** Completion of internship.

**Registration Restrictions:**
- **Required Prerequisites:** SWE 301\(^C\) or 301\(^{XS}\).
  - \(^C\) Requires minimum grade of C.
  - \(^{XS}\) Requires minimum grade of XS.

Students with the terminated from CEC major attribute may **not** enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Satisfactory/No Credit scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 419: *Object-Oriented Software Design and Implementation*. 3 credits.
In-depth study of software design and implementation using a modern, object-oriented language with support for graphical user interfaces and complex data structures. Topics covered are specifications, design patterns, and abstraction techniques, including typing, access control, inheritance, and polymorphism. Students will learn the proper engineering use of techniques such as information hiding, classes, objects, inheritance, exception handling, event-based systems, and concurrency. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). Limited to two attempts.

**Registration Restrictions:**
- **Required Prerequisites:** ((CS 310\(^C\) or 310\(^{XS}\)) and (MATH 125\(^C\) or 125\(^{XS}\)).
  - \(^C\) Requires minimum grade of C.
  - \(^{XS}\) Requires minimum grade of XS.

Enrollment is limited to students with a major in Applied Computer Science or Computer Science.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 421: *Software Architectures*. 3 credits.
Introduces students to the conceptual models and tools used to design and develop software systems. Students will learn the processes involved in software architecture design and evaluation, including the use of architectural styles, patterns, and models. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). Limited to two attempts.

**Registration Restrictions:**
- **Required Prerequisites:** (MATH 125\(^C\) or 125\(^{XS}\)) and (CS 310\(^C\) or 310\(^{XS}\)).
  - \(^C\) Requires minimum grade of C.
  - \(^{XS}\) Requires minimum grade of XS.

Students with the terminated from CEC major attribute may **not** enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

Concepts and techniques for testing and modifying software in evolving environments. Topics include software testing at the unit, module, subsystem, and system levels; developer testing; automatic and manual techniques for generating test data; testing concurrent and distributed software; designing and implementing software to increase maintainability and reuse; evaluating software for change; and validating software changes. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). Limited to two attempts.

**Registration Restrictions:**
- **Required Prerequisites:** (CS 310\(^C\) or 310\(^{XS}\)) and (CS 421\(^C\) or 421\(^{XS}\)).
  - \(^C\) Requires minimum grade of C.
  - \(^{XS}\) Requires minimum grade of XS.

Students with the terminated from CEC major attribute may **not** enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 443: *Software Architectures*. 3 credits.
Introduces students to the conceptual models and tools used to design and develop software systems. Students will learn the processes involved in software architecture design and evaluation, including the use of architectural styles, patterns, and models. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). Limited to two attempts.

**Registration Restrictions:**
- **Required Prerequisites:** (MATH 125\(^C\) or 125\(^{XS}\)) or CS 421\(^C\) or CS 421\(^{XS}\).
  - \(^C\) Requires minimum grade of C.
  - \(^{XS}\) Requires minimum grade of XS.

Students with the terminated from CEC major attribute may **not** enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Undergraduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 510: *Object-Oriented Programming in Java*. 3 credits.
Introduces students to programming in the Java language. Topics include problem-solving methods and algorithm development, program structure, and design patterns. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). Limited to two attempts.
structures, abstract data types, simple data and file structures and program development in a modular, object-oriented manner. Introductory use of OO language features, including data hiding, inheritance, polymorphism, and exception handling. Goals include design and development of Java classes and class type hierarchies. An introduction to Java servlets and applets is included. Emphasis on program development is reinforced through several programming projects. Notes: Credit cannot be applied to a graduate degree in the Volgenau School or the BS degree in computer science. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** Undergraduate courses or equivalent knowledge in programming in a high-level language.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

### 600 Level Courses

**SWE 619: Object-Oriented Software Specification and Construction.** 3 credits.
In-depth study of software construction using modern, object-oriented language with support for graphical user interfaces and complex data structures. Specifications, design patterns, and abstraction techniques, including procedural, data, iteration, type, and polymorphic. Information hiding, classes, objects, and inheritance. Exception handling, event-based systems, and concurrency. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** SWE foundation courses or equivalent.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 620: Software Requirements Analysis and Specification.** 3 credits.
In-depth study of object-oriented requirements modeling, including use case modeling, static modeling and dynamic modeling with Unified Modeling Language (UML) notation. Students participate in group project on software requirements and specification using modern method. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** SWE foundation courses or equivalent.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 621: Software Design and Architecture.** 3 credits.
An examination of the methods, processes, and notations for working with architecture and design in software. Exploration of design as the enumeration, evaluation, and selection of design alternatives to achieve quality attributes. Surveys perspectives on design from risk minimization, domain modeling, abstraction, architectural styles, design patterns, and reuse. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** SWE foundation courses or equivalent.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 622: Distributed Software Engineering.** 3 credits.
Hands-on introduction to techniques and programming interfaces for distributed software engineering. Networking protocols at several layers. Construction of distributed and concurrent software using network protocol services. Applications of Internet and web-based software. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** SWE foundation courses or equivalent.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the Engineering Computing college.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 625: Software Project Management.** 3 credits.
Lifecycle and process models; process metrics; planning for a software project; mechanisms for monitoring and controlling schedule, budget, quality, and productivity; and leadership, motivation, and team building. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** SWE foundation courses or equivalent.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the Engineering Computing college.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 626: Software Project Laboratory.** 3 credits.
Covers requirements analysis, design, implementation, and management of software development project. Students work in teams to develop or modify software product, applying sound principles of software engineering. Uses both industrial and academic standards to assess quality of work products. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** SWE 619, 620, and 621; or permission of instructor.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the Engineering Computing college.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 631: Software Design Patterns.** 3 credits.

**Recommended Prerequisite:** SWE 621.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the Engineering Computing college.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 632: User Interface Design and Development.** 3 credits.
Principles of user interface design, development, and programming. Includes user psychology and cognitive science, menu system design, command language design, icon and window design, graphical user interfaces, web-based user interfaces. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** SWE 619, or CS 540 and 571, or permission of instructor.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the Engineering Computing college.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 637: Software Testing.** 3 credits.
Students learn to test software effectively. Programmers learn practical ways to design high quality tests during all phases of software development. Students learn the theory behind criteria-based test design and to apply that theory in practice. Topics include test design, test
Software Engineering (SWE) 642: Software Engineering for the World Wide Web. 3 credits. Detailed study of engineering methods and technologies for building highly interactive web sites for e-commerce and other web-based applications. Presents engineering principles for building web sites that exhibit high reliability, usability, security, availability, scalability, and maintainability. Teaches methods such as client/server programming, component-based software development, middleware, and reusable components. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

Recommended Prerequisite: SWE 619 or CS 540 and CS 571, or permission of instructor.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.
Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.
Students in a Non-Degree Undergraduate degree may not enroll.
Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 642: Software Engineering for the World Wide Web. 3 credits. Detailed study of engineering methods and technologies for building highly interactive web sites for e-commerce and other web-based applications. Presents engineering principles for building web sites that exhibit high reliability, usability, security, availability, scalability, and maintainability. Teaches methods such as client/server programming, component-based software development, middleware, and reusable components. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit. Equivalent to ISA 681.

Recommended Prerequisite: SWE 619.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.
Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.
Students in a Non-Degree Undergraduate degree may not enroll.
Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 681: Secure Software Design and Programming. 3 credits. Theory and practice of software security, focusing in particular on some common software security risks, including buffer overflows, race conditions and random number generation, and the identification of potential threats and vulnerabilities early in the design cycle. Emphasis is on methodologies and tools for identifying and eliminating security vulnerabilities, techniques to prove the absence of vulnerabilities, and ways to avoid security holes in new software and on essential guidelines for building secure software. Explores how to design software with security in mind from the ground up and integrate analysis and risk management throughout the software life cycle. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

Recommended Prerequisite: SWE 619.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.
Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.
Students in a Non-Degree Undergraduate degree may not enroll.
Enrollment limited to students in the Engineering Computing college.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 699: Special Topics in Software Engineering. 3 credits. Special topics not occurring in regular SWE sequence. Notes: May be repeated for credit when semester topic is different. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May be repeated within the term.

Specialized Designation: Topic Varies

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.
Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.
Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the Engineering Computing college.

**Schedule Type:** Lec/Sem #1, Lec/Sem #2, Lec/Sem #3, Lec/Sem #4, Lec/Sem #5, Lec/Sem #6, Lec/Sem #7, Lec/Sem #8, Lec/Sem #9, Lecture, Sem/Lec #10, Sem/Lec #11, Sem/Lec #12, Sem/Lec #13, Sem/Lec #14, Sem/Lec #15, Sem/Lec #16, Sem/Lec #17, Sem/Lec #18

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

### 700 Level Courses

**SWE 721:** Reusable Software Architectures. 3 credits.
Investigates software concepts that promote reuse of software architectures. Studies influence of object technology on software design and reuse. Investigates domain modeling methods, which model the application domain as a software product family from which target systems can be configured. Covers reusable software patterns including architecture patterns and design patterns, software components, and object-oriented frameworks. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** SWE 621.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the Engineering Computing college.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 724:** Program Analysis for Software Testing. 3 credits.
Different methods for analyzing software, primarily for purpose of testing. Analysis techniques, algorithms, tools, and applications. Goals are to explore current research issues, learn how to build analysis tools, and understand how these techniques can be applied to software-related activities such as maintenance, reuse and optimization. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** A compiler class (e.g. CS 540) OR a testing class (e.g. SWE 637) or permission of the instructor.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 737:** Advanced Software Testing. 3 credits.
Cutting edge concepts and techniques in software testing. An in-depth study of existing approaches to testing software as well as development of new approaches. Applications of existing concepts and techniques to new technologies. Advanced MS students learn in-depth knowledge for how to apply testing in difficult and challenging real-world scenarios. PhD students learn current research trends, both theoretical and practical. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** SWE 637.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the Engineering Computing college.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 760:** Software Analysis and Design of Real-Time Systems. 3 credits.
Background for students who want to conduct research in software engineering of real-time systems. Provides understanding of key real-time software system analysis, design concepts and methods, and how they are used in developing large-scale, real-time software systems. Also explores potential impact of emerging technologies. Includes term project in design and analysis of complex, real-time software system. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** SWE 621.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the Engineering Computing college.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

**SWE 763:** Software Engineering Experimentation. 3 credits.
Detailed study of scientific process, particularly using experimental method. Examines how empirical studies are carried out in software engineering. Reviews distinction between analytical techniques and empirical techniques. Other topics include experimentation required in software engineering, problems that can be solved using experimentation, methods used to control variables and eliminate bias in experimentation, and analysis and presentation of empirical data for decision making. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

**Recommended Prerequisite:** SWE 621, or permission of instructor.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the Engineering Computing college.
Students in a Non-Degree Undergraduate degree may enroll.

Enrollment is limited to Graduate or Non-Degree level students.

Registration Restrictions:
- Recommended Prerequisite: 12 credits applicable toward MS.
- Specialized Designation: Topic Varies
- Recommended Prerequisite: 12 credits applicable toward MS.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 795: Advanced Topics in Software Engineering. 3 credits.
Advanced topics not occurring in existing courses. Topics normally assume knowledge in one or more existing MS SWE courses. Notes: Repeatable within degree for credit when subject differs. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May be repeated within the degree for a maximum 6 credits.

Specialized Designation: Topic Varies

Recommended Prerequisite: 12 credits applicable toward MS.

Registration Restrictions:
- Enrollment is limited to Graduate or Non-Degree level students.
- Students in a Non-Degree Undergraduate degree may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 796: Directed Readings in Software Engineering. 3 credits.
Analysis and investigation of contemporary problem in software engineering. Requires prior approval by faculty member who supervises student’s work. Written report also required. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May not be repeated for credit.

Registration Restrictions:
- Enrollment is limited to Graduate or Non-Degree level students.
- Students in a Non-Degree Undergraduate degree may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 797: Advanced Topics in Software Engineering. 3 credits.
Advanced topics not occurring in existing courses. Topics normally assume knowledge in one or more existing MS SWE courses. Notes: Repeatable within degree for credit when subject differs. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May be repeated within the degree for a maximum 6 credits.

Specialized Designation: Topic Varies

Recommended Prerequisite: 12 credits applicable toward MS.

Registration Restrictions:
- Enrollment is limited to Graduate or Non-Degree level students.
- Students in a Non-Degree Undergraduate degree may not enroll.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 798: Research Project. 3 credits.
Master’s student undertake a project using knowledge gained in prior MS courses. Topic chosen under the guidance of a member of the Graduate Faculty of the department, resulting in written technical report. Prior approval is required by the faculty sponsor. To register, student must complete a Master’s Project form available from the department. It must be signed by the faculty sponsor and approved by the department chair or delegate. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May be repeated within the degree for a maximum 6 credits.

Recommended Prerequisite: 18 credits applicable towards MS degree.

Registration Restrictions:
- Enrollment is limited to Graduate or Non-Degree level students.
- Students in a Non-Degree Undergraduate degree may not enroll.

Schedule Type: Seminar

Grading:
This course is graded on the Satisfactory/No Credit scale. (http://catalog.gmu.edu/policies/academic/grading/)

SWE 821: Software Engineering Seminar. 3 credits.
Study of application of software engineering principles, design methods, and support tools through real-life problems extracted from faculty and industry projects. Notes: May be repeated with change in topic. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May be repeated within the degree for a maximum 6 credits.

Recommended Prerequisite: SWE 621

Registration Restrictions:
- Enrollment is limited to Graduate level students.
- Enrollment limited to students in the Engineering Computing college.

Schedule Type: Seminar

Grading:
This course is graded on the Satisfactory/No Credit scale. (http://catalog.gmu.edu/policies/academic/grading/)

800 Level Courses

SWE 821: Software Engineering Seminar. 3 credits.
Study of application of software engineering principles, design methods, and support tools through real-life problems extracted from faculty and industry projects. Notes: May be repeated with change in topic. Offered by Computer Science (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/). May be repeated within the degree for a maximum 6 credits.

Recommended Prerequisite: SWE 621

Registration Restrictions:
- Enrollment is limited to Graduate level students.
- Enrollment limited to students in the Engineering Computing college.

Schedule Type: Seminar

Grading:
This course is graded on the Satisfactory/No Credit scale. (http://catalog.gmu.edu/policies/academic/grading/)