SOFTWARE ENGINEERING

Software Engineering is the computer discipline that is concerned with the theoretical and practical aspects of building high quality software systems, on time, and within budget. Software engineers are tasked with the detailed analysis, design, implementation, testing, maintenance and management of software product development projects for a broad range of computing applications across society.

The increasing pressure to deliver high-quality, reliable software products in less time is rapidly fueling the demand for computer professionals with specific preparation in software engineering and experience in working on teams. These pressures stem from such widespread development as

• The use of software for demanding and safety-critical applications that make it imperative to avoid the serious, indeed sometimes fatal, consequences of poorly understood design.
• The need to create consumer and entertainment applications like computer games, in the face of a highly competitive global market place.
• The increasing need to develop useful, easy-to-use software tools that reliably meet customer needs and whose features and documentation can be used and understood by their intended user with a high degree of consistency and confidence.
• The need to re-engineer or replace aging legacy software systems to take advantage of modern computer hardware capabilities.

Recent advances in the practice and technology of software engineering have made it possible to offer undergraduate and graduate degree programs in software engineering itself. Notable among these advances are:

• The availability of proven computer tools (such as CASE tools) and processes (such as the Personal Software Process) to standardize and automate software development.
• The increasing importance of formal methods and software quality measurement techniques to ensure more thorough testing of software.
• The success of the agile and object-oriented software engineering methods, as well as the move toward technical and managerial practices that cover the full software development cycle.

Software engineers must know the subset of computer science that is relevant to software development. They must also have knowledge of the principles of effective and reliable design, of mathematics and other sciences that are traditionally known by engineers, and of the skills and applications of project management.

Software engineering includes:

• Software design and development; that is, building commercial, industrial-strength software by the application of validated knowledge and experience that have been codified into formal methods of best practices.
• Software process and quality assurance; that is, the systematic discipline of consciously improving the quality, cost and timeliness of the process itself by which large software systems are designed and developed.
• Software development project management; that is, how to manage large software design projects and bring development to a timely and efficient completion.

The software engineering degree program offered by the Department of Computer and Information Science stresses the range of technical, systematic, and managerial aspects of the software engineering process but places primary emphasis on the technical facets of designing, building, and modifying large and complex software systems. This program concentrates on all software development lifecycle phases, including: program management, requirements engineering, software architecture design, software implementation, software configuration management, software quality assurance, and software process maturity measurements and improvements. It balances both theoretical and practical aspects by covering fundamentals in the classroom and evaluating student knowledge by implementing team-based work projects. Students complete a minimum of 120 credits and receive a BS degree in Software Engineering. The degree prepares graduates for immediate employment in the software engineering field and for graduate study.

The BS in Software Engineering program is accredited by the Engineering Accreditation Commission of ABET, abet.org

415 North Charles Street,
Suite 1050,
Baltimore, MD 21201
Telephone: (410) 347-7700.

Program Objectives

1. Our graduates will be successfully employed in software engineering—related field or another career path, in an industrial, commercial, academic, governmental, or non-governmental organization, or will be a successful graduate student in a program preparing them for such employment.
2. Our graduates will lead and participate in culturally diverse teams, become global collaborators and adapting to an ever-changing field.
3. Our graduates will continue professional development by obtaining continuing education credits, professional registration or certifications, or post-graduate study credits or degrees.

Program Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering;
2. An ability to design and conduct experiments, as well as to analyze and interpret data;
3. An ability to design a system, component, or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
4. An ability to function on multidisciplinary teams;
5. An ability to identify, formulate, and solve engineering problems;
6. An understanding of professional and ethical responsibility;
7. An ability to communicate effectively;
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
9. A recognition of the need for, and an ability to engage in, life-long learning;
10. A knowledge of contemporary issues;
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
12. An ability to program.
13. An ability to manage a project.

Concentration Requirements

A candidate for the degree Bachelor of Science in Software Engineering is required to pursue scholastic quality and to complete satisfactorily the following program of study:

(120 hours minimum)

Dearborn Discovery Core Requirement

The minimum passing grade for a Dearborn Discovery Core (DDC) course is 2.0. The minimum GPA for the program is 2.0. In addition, the DDC permits any approved course to satisfy up to three credit hours within three different categories. Please see the General Education Program: The Dearborn Discovery Core (http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core) section for additional information.

Foundational Studies

Written and Oral Communication (GEWO) – 6 Credits (http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gewo)

Upper Level Writing Intensive (GEWI) – 3 Credits (http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gewi)

Quantitative Thinking and Problem Solving (GEQT) – 3 Credits (http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#geqt)

Critical and Creative Thinking (GECC) – 3 Credits (http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gecc)

Areas of Inquiry

Natural Science (GENS) – 7 Credits (http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gens)

- Lecture/Lab Science Course
- Additional Science Course

Social and Behavioral Analysis (GESB) – 9 Credits (http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gesb)

Humanities and the Arts (GEHA) – 6 Credits (http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#geha)

Intersections (GEIN) – 6 Credits (http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gein)

Capstone

Capstone (GECE) – 3 Credits (http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gece)

General Requirements

In addition to completion of the Dearborn Discovery Core, the following courses are required to earn a BS degree in Software Engineering from UM-Dearborn.

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>COMP 270</td>
<td>Tech Writing for Engineers (Also fulfills 3 credits of DDC Written and Oral Communication)</td>
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<tr>
<td>ECON 201</td>
<td>Prin: Macroeconomics (Also fulfills 3 credits of DDC Social and Behavioral Analysis)</td>
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Mathematics

MATH 115  Calculus I  4
MATH 116  Calculus II  4
CIS 275  Discrete Structures I  4
CIS 306  Discrete Structures II  4
MATH 217  Intro to Matrix Algebra  2-3
or MATH 227  Introduction to Linear Algebra  
IMSE 317  Eng Probability and Statistics  3

Laboratory Science Sequence

Select two courses, 8 credits, in one sequence from:

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>BIOL 130 &amp; BIOL 140</td>
<td>Intro Org and Environ Biology and Intro Molec &amp; Cellular Biology</td>
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<tr>
<td>CHEM 134 &amp; CHEM 136</td>
<td>General Chemistry IA and General Chemistry IIA</td>
<td></td>
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<tr>
<td>CHEM 144 &amp; CHEM 146</td>
<td>Gen Chemistry IB and General Chemistry IIB</td>
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</tr>
<tr>
<td>GEOL 118 &amp; GEOL 218</td>
<td>Physical Geology and Historical Geology</td>
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<tr>
<td>PHYS 125 &amp; PHYS 126</td>
<td>Introductory Physics I and Introductory Physics II</td>
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<tr>
<td>PHYS 150 &amp; PHYS 151</td>
<td>General Physics I and General Physics II</td>
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Natural Science

Select four credits from:

<table>
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<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>ASTR 130</td>
<td>Introduction to Astronomy &amp; ASTR 131</td>
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<tr>
<td>BIOL 130</td>
<td>Intro Org and Environ Biology &amp; BIOL 140</td>
<td></td>
</tr>
<tr>
<td>CHEM 134</td>
<td>General Chemistry IA</td>
<td></td>
</tr>
<tr>
<td>CHEM 136</td>
<td>General Chemistry IIA</td>
<td></td>
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<tr>
<td>CHEM 144</td>
<td>Gen Chemistry IB</td>
<td></td>
</tr>
<tr>
<td>CHEM 146</td>
<td>General Chemistry IIB</td>
<td></td>
</tr>
<tr>
<td>CHEM 225</td>
<td>Organic Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHEM 226</td>
<td>Organic Chemistry II</td>
<td></td>
</tr>
<tr>
<td>CHEM 227</td>
<td>Organic Chemistry Laboratory</td>
<td></td>
</tr>
<tr>
<td>GEOL 118</td>
<td>Physical Geology &amp; GEOL 218</td>
<td></td>
</tr>
<tr>
<td>PHYS 125</td>
<td>Introductory Physics I &amp; PHYS 126</td>
<td></td>
</tr>
<tr>
<td>PHYS 150</td>
<td>General Physics I &amp; PHYS 151</td>
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Business Courses
OB 354  Behavior in Organization  3

CIS Core
Seven computer and information science courses are required.
CIS 150  Computer Science I  4
CIS 200  Computer Science II  4
CIS 310  Computer Org and Assembly Lang  4
CIS 3501 Data Struc & Alg Anlys for SE  4
CIS 375  Software Engineering I  4
CIS 427  Comp Networks and Dis Process  4
CIS 450  Operating Systems  4

Software Engineering Requirements
CIS 285  Software Engineering Tools  3
CIS 376  Software Engineering II  4
CIS 476  Soft Arch & Design Patterns  3
CIS 4961 Design Seminar for SE I  2
CIS 4962 Design Seminar for SE II  2

One Application Sequence 1
Select 7-9 credit hours:  7-9

Information Systems Sequence
CIS 425  Information Systems  4
CIS 447  Intro Computr & Ntwrk Security  3

Computer Game Design Sequence
CIS 297  Intro to C Sharp  3
CIS 487  Computer Game Design & Implem  3
CIS 488  Computer Game Design II  3

Web Engineering Sequence
CIS 421  Database Mgmt Systems  4

Take one of the following two courses:
CIS 435  Web Technology
CIS 436  Mobile App Des & Impl

Technical Electives 1
Select 8-10 additional credits from the following. Only one course from CIS 296 or CIS 297 may be used towards the 120 credits of the degree:
CIS 296  Java Programming
   or CIS 297  Intro to C Sharp
CIS 381  Industrial Robots
CIS 387  Digital Forensics I
CIS 400  Programming Languages
CIS 405  Algorithm Analysis & Design
CIS 421  Database Mgmt Systems
CIS 423  Dec Support and Exp Systems
CIS 425  Information Systems
CIS 435  Web Technology
CIS 436  Mobile App Des & Impl
CIS 437  Advanced Networking
CIS 447  Intro Computr & Ntwrk Security
CIS 451  Computer Graphics
CIS 452  Inf Vis & Multimedia Gaming
CIS 467  Digital Forensics II
CIS 474  Compiler Design
CIS 479  Intro to Artificial Intel

CIS 487  Computer Game Design & Implem
CIS 488  Computer Game Design II
ECE 372  Intro to Microprocessors
ECE 473  Embedded System Design
ENGR 400  Appl Business Tech for Engr
ENT 400  Entrepreneurial Thinking&Behav

General Electives
Select four credit hours 3  4

1 The Application Area and Technical Electives must total 17 hrs
3 Any for-credit courses; that is, courses not on the No Credit list, which is found at the end of the CECS Student Handbook.