COMPUTER SCIENCE (MS) ONLINE

The MS in Computer Science exposes students to the complete life-cycle of computer application development including abstraction, modeling and algorithm development, leveraging computer systems, programming languages and development frameworks, and software development techniques and processes. It prepares students for a professional career in Software Development or Computer Science Research.

Program Requirements	Quarter Hours
Introductory Courses	0-24
Degree Requirements	48
Total hours required	**48-72**

Learning Outcomes

- Model a computational problem, select appropriate algorithms and data structures for a solution, justify the correctness of the algorithm, and implement an application solving the problem.
- Demonstrate proficiency with fundamental concepts in algorithms, programming languages, software engineering, distributed systems, and databases.
- Demonstrate an in-depth knowledge in at least one area of Computer Science.
- Demonstrate the ability to independently learn and master new software development paradigms, algorithms, APIs, and programming languages.

Degree Requirements

Course Requirements

No Introductory Course may be substituted for any other course at any level.

Introductory Courses

Introductory courses may be waived for any of the following conditions:

- The student has the appropriate course work to satisfy an Introductory Course.
- The student has appropriate and verified professional experience to satisfy an Introductory Course.
- If an exam is available, the student passes a Graduate Assessment Examination (GAE) in the Introductory Course area.

Introductory Courses

Course	Title	Quarter Hours
CSC 400	DISCRETE STRUCTURES FOR COMPUTER SCIENCE	4
CSC 401	INTRODUCTION TO PROGRAMMING	4
CSC 402	DATA STRUCTURES I	4
CSC 403	DATA STRUCTURES II	4
CSC 406	SYSTEMS I	4
CSC 407	SYSTEMS II	4

Foundation Courses

Course	Title	Quarter Hours
CSC 421	APPLIED ALGORITHMS AND STRUCTURES	4
CSC 435	DISTRIBUTED SYSTEMS I	4
CSC 447	CONCEPTS OF PROGRAMMING LANGUAGES	4
CSC 453	PRINCIPLES OF DATABASE MANAGEMENT SYSTEMS	4
SE 450	OBJECT-ORIENTED SOFTWARE DEVELOPMENT	4
or SE 456	ARCHITECTURE OF REAL-TIME SYSTEMS	

Major Electives

Twenty-eight credit hours of Major Electives are required. Graduates of the MS in Computer Science program must be proficient in at least one broad area of Computer Science listed below. For this reason students will take the remaining twenty-eight credit hours as follows:

- Twelve credit hours (typically taken as three 4-credit courses) from one area
- SIxteen credit hours (typically taken as four 4-credit courses) from any area, including the option to take the SE Studio Capstone, the 2-course GAM studio sequence, the 1-course CS capstone, the Research Colloquium course, or write an MS Thesis, or develop an MS Research Project.

The courses in each area are listed below. The Independent Study courses (CSC 695) may be taken for up to 8 credits and at most 4 credit hours of CSC 695 can count towards the chosen area.

Areas

Software and System Development Area

Course	Title	Quarter Hours
CSC 436	WEB APPLICATIONS	
CSC 438	FRAMEWORK FOR WEB APPLICATION DEVELOPMENT	
CSC 439	COMPUTER SECURITY	
CSC 443	INTRODUCTION TO OPERATING SYSTEMS	
CSC 448	COMPILER DESIGN	
CSC 461	OPTIMIZED C++	
CSC 463	THEORY AND PRACTICE OF SAFE SYSTEMS PROGRAMMING	
CSC 464	VIRTUALIZATION AND CLOUD COMPUTING	
CSC 466	PROGRAM ANALYSIS	
CSC 471	MOBILE APPLICATION DEVELOPMENT FOR IOS	
CSC 472	MOBILE APPLICATION DEVELOPMENT FOR ANDROID	
CSC 491	MOBILE APPLICATION DEVELOPMENT FOR IOS II	
CSC 492	MOBILE APPLICATION DEVELOPMENT FOR ANDROID II	
CSC 534	SOFTWARE DEVELOPMENT FOR LIMITED AND EMBEDDED DEVICES	
CSC 536	DISTRIBUTED SYSTEMS II	

CSC 540	MOBILE APPLICATION DEVELOPMENT II
CSC 548	ADVANCED COMPILER DESIGN
CSC 549	DATABASE SYSTEM IMPLEMENTATION
CSC 551	DISTRIBUTED DATABASE SYSTEMS
CSC 552	CONCURRENT SOFTWARE DEVELOPMENT
CSC 553	ADVANCED DATABASE CONCEPTS
CSC 562	OPTIMIZED C++ MULTITHREADING
CSC 588	REAL-TIME MULTITHREADED ARCHITECTURE
CSC 595	TOPICS IN COMPUTER SCIENCE
CSE 451	EMBEDDED SYSTEMS I
CSE 452	EMBEDDED SYSTEMS II
CSE 475	INTRODUCTION TO ROBOTICS (FORMERLY CSC 475)
CSEC 450	DIGITAL FORENSIC TECHNIQUES
CSEC 488	SECURITY TESTING AND ASSESSMENT
CSEC 489	ADVANCED CYBER ATTACK RESPONSES AND DEFENSES
GAM 690	GAME DEVELOPMENT STUDIO I
GAM 691	GAME DEVELOPMENT STUDIO II
SE 441	CONTINUOUS DELIVERY AND DEVOPS
SE 452	OBJECT-ORIENTED ENTERPRISE COMPUTING
SE 459	AGILE SOFTWARE DEVELOPMENT
SE 488	AI-DRIVEN SOFTWARE DEVELOPMENT
SE 489	MACHINE LEARNING ENGINEERING FOR PRODUCTION (MLOPS)
SE 491	SOFTWARE ENGINEERING STUDIO
SE 525	SOFTWARE SECURITY ARCHITECTURE
SE 526	SOFTWARE SECURITY ASSESSMENT
SE 554	ENTERPRISE COMPONENT ARCHITECTURE
SE 560	STRUCTURED DOCUMENT INTERCHANGE AND PROCESSING
SE 591	SOFTWARE ENGINEERING STUDIO II
NET 470	CLOUD NETWORKING TECHNOLOGIES
NET 478	INFORMATION STORAGE AND MANAGEMENT
NET 484	SCRIPTING FOR NETWORK MANAGEMENT
NET 568	NETWORK MANAGEMENT

Theory Area

Course	Title	Quarter Hours
CSC 431	SCIENTIFIC COMPUTING	
CSC 440	CRYPTOLOGY	
CSC 444	AUTOMATA THEORY AND FORMAL GRAMMARS	
CSC 489	THEORY OF COMPUTATION	
CSC 503	PARALLEL ALGORITHMS	
CSC 521	MONTE CARLO ALGORITHMS	
CSC 525	COMBINATORIAL OPTIMIZATION	
CSC 531	INTRODUCTION TO BIOINFORMATICS	

CSC 535	FORMAL SEMANTICS OF PROGRAMMING LANGUAGES
CSC 557	FOUNDATIONS OF COMPUTER SECURITY
CSC 547	ADVANCED TOPICS IN PROGRAM LANGUAGES
CSC 591	TOPICS IN ALGORITHMS
SE 533	SOFTWARE VALIDATION AND VERIFICATION

Data Science Area

Course	Title	Quarter Hours
CSC 468	PROGRAMMING INTERACTIVE DATA VISUALIZATION FOR THE WEB	
CSC 481	INTRODUCTION TO IMAGE PROCESSING	
CSC 482	APPLIED IMAGE ANALYSIS	
CSC 555	MINING BIG DATA	
CSC 575	INTELLIGENT INFORMATION RETRIEVAL	
CSC 578	ADVANCED DEEP LEARNING	
CSC 594	TOPICS IN ARTIFICIAL INTELLIGENCE	
CSC 598	TOPICS IN DATA ANALYSIS	
DSC 423	DATA ANALYSIS AND REGRESSION	
DSC 424	ADVANCED MODELING AND ANALYSIS TECHNIQUES	
DSC 425	TIME SERIES ANALYSIS AND FORECASTING	
DSC 433	SCRIPTING FOR DATA ANALYSIS	
DSC 441	FUNDAMENTALS OF DATA SCIENCE	
DSC 445	MACHINE LEARNING I (FORMERLY DSC 540)	
DSC 465	DATA VISUALIZATION	
DSC 478	PROGRAMMING MACHINE LEARNING APPLICATIONS	
DSC 480	SOCIAL NETWORK ANALYSIS	
DSC 484	WEB DATA MINING	
DSC 672	DATA SCIENCE CAPSTONE	

Database Systems Area

Course	Title	Quarter Hours
CSC 452	DATABASE PROGRAMMING	
CSC 454	DATABASE ADMINISTRATION AND MANAGEMENT	
CSC 543	SPATIAL DATABASES & GEOGRAPHIC INFORMATION SYSTEMS	
CSC 549	DATABASE SYSTEM IMPLEMENTATION	
CSC 551	DISTRIBUTED DATABASE SYSTEMS	
CSC 553	ADVANCED DATABASE CONCEPTS	
CSC 554	ADVANCED DATABASE MANAGEMENT	
CSC 555	MINING BIG DATA	
CSC 575	INTELLIGENT INFORMATION RETRIEVAL	
CSC 589	TOPICS IN DATABASE	
DSC 433	SCRIPTING FOR DATA ANALYSIS	
DSC 445	MACHINE LEARNING I (FORMERLY DSC 540)	

DSC 478	PROGRAMMING MACHINE LEARNING APPLICATIONS

Artificial Intelligence Area

Course	Title	Quarter Hours
CSC 457	EXPERT SYSTEMS	
CSC 458	SYMBOLIC PROGRAMMING	
CSC 480	ARTIFICIAL INTELLIGENCE I	
CSC 481	INTRODUCTION TO IMAGE PROCESSING	
CSC 482	APPLIED IMAGE ANALYSIS	
CSC 484	ETHICS IN ARTIFICIAL INTELLIGENCE	
CSC 528	COMPUTER VISION	
CSC 538	VISION SYSTEMS	
CSC 575	INTELLIGENT INFORMATION RETRIEVAL	
CSC 576	COMPUTATIONAL ADVERTISING	
CSC 577	RECOMMENDER SYSTEMS	
CSC 578	ADVANCED DEEP LEARNING	
CSC 580	ARTIFICIAL INTELLIGENCE II	
CSC 583	NATURAL LANGUAGE PROCESSING	
CSC 587	COGNITIVE SCIENCE	
CSC 592	TOPICS IN COMPUTER VISION AND PATTERN RECOGNITION	
CSC 594	TOPICS IN ARTIFICIAL INTELLIGENCE	
DSC 441	FUNDAMENTALS OF DATA SCIENCE	
DSC 445	MACHINE LEARNING I (FORMERLY DSC 540)	
DSC 484	WEB DATA MINING	
DSC 478	PROGRAMMING MACHINE LEARNING APPLICATIONS	
DSC 480	SOCIAL NETWORK ANALYSIS	
GEO 441	GEOGRAPHIC INFORMATION SYSTEMS (GIS) FOR COMMUNITY DEVELOPMENT	
GEO 442	GEOGRAPHICAL INFORMATION SYSTEMS (GIS) FOR SUSTAINABLE URBAN DEVELOPMENT	

Software Engineering Area

Course	Title	Quarter Hours
SE 430	OBJECT ORIENTED MODELING	
SE 433	SOFTWARE TESTING AND QUALITY ASSURANCE	
SE 441	CONTINUOUS DELIVERY AND DEVOPS	
SE 452	OBJECT-ORIENTED ENTERPRISE COMPUTING	
SE 453	ARCHITECTURE AND FRAMEWORKS FOR DEVELOPING CLIENT APPLICATIONS	
SE 456	ARCHITECTURE OF REAL-TIME SYSTEMS	
SE 459	AGILE SOFTWARE DEVELOPMENT	
SE 457	SERVICE-ORIENTED ARCHITECTURE	
SE 475	MANAGING GLOBALLY DISTRIBUTED SOFTWARE DEVELOPMENT	
SE 477	SOFTWARE AND SYSTEMS PROJECT MANAGEMENT	

SE 480	SOFTWARE ARCHITECTURE I
SE 482	REQUIREMENTS ENGINEERING
SE 485	REAL-TIME SOFTWARE DEVELOPMENT I
SE 576	GPU Architecture
SE 585	REAL-TIME SOFTWARE DEVELOPMENT II
SE 491	SOFTWARE ENGINEERING STUDIO
SE 525	SOFTWARE SECURITY ARCHITECTURE
SE 526	SOFTWARE SECURITY ASSESSMENT
SE 533	SOFTWARE VALIDATION AND VERIFICATION
SE 529	SOFTWARE RISK MANAGEMENT
SE 546	SOFTWARE ARCHITECTURE AND DESIGN FOR DESKTOP APPLICATIONS
SE 549	MODEL-DRIVEN SOFTWARE DEVELOPMENT
SE 554	ENTERPRISE COMPONENT ARCHITECTURE
SE 556	ADVANCED ARCHITECTURE OF COMPUTER GAMES
SE 560	STRUCTURED DOCUMENT INTERCHANGE AND PROCESSING
SE 579	ANALYTICS AND DATA MINING IN SOFTWARE ENGINEERING
SE 581	SOFTWARE ARCHITECTURE II
SE 582	SOFTWARE-INTENSIVE SYSTEMS ENGINEERING AND MANAGEMENT

Game and Real-Time Systems Area

Course	Title	Quarter Hours
CSC 461	OPTIMIZED C++	
CSC 486	REAL-TIME NETWORKING (FORMERLY GAM 490)	
CSC 562	OPTIMIZED C++ MULTITHREADING	
CSC 588	REAL-TIME MULTITHREADED ARCHITECTURE	
GAM 425	APPLIED 3D GEOMETRY	
GAM 450	PHYSICS FOR GAME DEVELOPERS	
GAM 453	TOOL PROGRAMMING FOR GAME DEVELOPMENT	
GAM 470	RENDERING AND GRAPHICS PROGRAMMING	
GAM 475	REAL - TIME SOFTWARE DEVELOPMENT	
GAM 476	ARTIFICIAL INTELLIGENCE FOR COMPUTER GAMES	
GAM 486	GAME PROGRAMMING FOR MOBILE DEVICES	
GAM 575	REAL-TIME SOFTWARE DEVELOPMENT II	
GAM 576	GPU ARCHITECTURE	
GAM 690	GAME DEVELOPMENT STUDIO I	
GAM 691	GAME DEVELOPMENT STUDIO II	
SE 456	ARCHITECTURE OF REAL-TIME SYSTEMS	

Human-Computer Interaction

Course	Title	Quarter Hours
CSC 436	WEB APPLICATIONS	
CSC 438	FRAMEWORK FOR WEB APPLICATION DEVELOPMENT	
CSC 471	MOBILE APPLICATION DEVELOPMENT FOR IOS	
CSC 472	MOBILE APPLICATION DEVELOPMENT FOR ANDROID	
CSC 491	MOBILE APPLICATION DEVELOPMENT FOR IOS II	
CSC 492	MOBILE APPLICATION DEVELOPMENT FOR ANDROID II	
DSC 465	DATA VISUALIZATION	
HCI 440	INTRODUCTION TO USER-CENTERED DESIGN	
HCI 430	PROTOTYPING AND IMPLEMENTATION	
HCI 457	INFORMATION ARCHITECTURE AND CONTENT STRATEGY	

As part of their electives, students have the option of signing up for the Research Colloquium, or completing a Research Project, or writing a Master's Thesis, or participating in a Graduate Internship.

Research Colloquium

The research colloquium consists of weekly talks by a variety of speakers including faculty, students, and guests from the academic and business communities. The lectures feature new creative and scholarly work that encompasses the disciplines and areas of interest of the School of Computing. Students interested in attending the colloquium and receiving credit should sign up for the CSC 500 course (NOTE: this course carries only 2 credits; it may be taken twice for credit.) Student evaluation is based on attendance as well as an online journal with reflections on each of the presentations. The educational objectives are to expose students to creative and scholarly research at DePaul and elsewhere, and to engage students in the thought process of identifying and solving challenging research problems.

Master's Research

Students interested in a more in-depth study of a particular area can choose to work with a faculty member (not necessarily their academic advisor) on an independent study or research project. The work involved may include system development, empirical studies, or theoretical work. The student will register for up to 4 credit hours of CSC 695. 4 credit hours of CSC 695 replaces one 500 level major elective course in the MS in Computer Science program. CSC 695 can be taken multiple times for up to 8 credit hours. Students must successfully complete the Foundation courses prior to their first enrollment in CSC 695. Students interested in the Master's Thesis option will typically take 8 credits of CSC 695.

Master's Thesis

A student who has made an original contribution to the area (typically, through work done by CSC 695) may choose to complete a Master's Thesis. The student and the student's research advisor should form a Master's Thesis Committee of 3 faculty. The student will need to submit to the committee a thesis detailing the results of the research project. After a public defense, the committee will decide whether to accept the thesis. In that case, the student will be allowed to register for the 0 credit course CSC 698 and the transcript will show the thesis title as the course topic.

Graduate Internship

In cooperation with local employers, the graduate program offers students the opportunity to integrate their academic experience with on-the-job training in computer related work areas. Students may take CSC 697 for up to four credits. Admission to the internship program requires consent of the instructor and a student services advisor. International students may complete curricular practical training (CPT) through this class provided they first obtain CPT authorization from International Student and Scholar Services (ISS) before beginning the internship.

Degree Requirements

Students in this degree program must meet the following requirements:

- Complete a minimum of 48 graduate credit hours in addition to any required introductory courses of the designated degree program.
- Complete all graduate courses and requirements listed in the designated degree program.
- Earn a grade of C- or better in all courses of the designated degree program.
- Maintain a cumulative GPA of 2.5 or higher.
- Students pursuing a second (or more) graduate degree may not double count or retake any course that applied toward the completion of a prior graduate degree. If a required course in the second degree was already completed and applied toward a previous degree, the student must meet with a faculty advisor to discuss a new course to be completed and substituted in the new degree. This rule also applies to cross-listed courses, which are considered to be the same course but offered under different subjects.
- Students pursuing a second master's degree must complete a minimum of 48 graduate credit hours beyond their first designated degree program in addition to any required introductory courses in their second designated degree program.

Students with a GPA of 3.9 or higher will graduate with distinction.

For DePaul's policy on repeat graduate courses and a complete list of academic policies see the DePaul Graduate Handbook.