Degree Offered
Master of Science

Program Description
The master of science in computer and information science is a professional degree designed to provide a pathway into the computer and information science profession or enhance the knowledge and skills of current professionals. This degree prepares students for new careers or strengthened skills in cybersecurity, data analytics, business and systems analysis, software engineering, project management, enterprise architecture, business process modeling and management, database design and administration, technology management and service management.

The program covers topics from computer science, computer engineering, software engineering, information systems, information technology, cybersecurity and data science. By design, the computer and information science program allows the student to pursue studies in any combination of these disciplines. With full-time and part-time options, students may choose either on-campus or fully online delivery. The on-campus program includes flexibility for students with evening and blended options and features the identical curriculum and faculty as our online delivery format.

An accelerated degree program (ADP) is offered, allowing current undergraduate students to complete both their bachelor's and master's degrees in five years. ADP students take classes during their junior or senior years that meet requirements for both their undergraduate and graduate degrees. The program also offers a career change opportunity for students with any undergraduate background and no formal background in computer science. Two optional specializations prepare students for successful careers in areas with high demand, namely cybersecurity and artificial intelligence and analytics.

Learning Outcomes
The program's learning outcomes reflect professional leadership competencies. Upon earning the master's degree in computer and information science, students will be able to:

1. Appraise relationships among a variety of computer and information science practices and technologies to create integrated solutions to computer and information science problems,
2. Communicate computer and information science problems and suggested solutions to other professionals and with business clients,
3. Formulate and defend realistic and detailed designs for solutions of problems of enterprise scope, and
4. Evaluate and apply common standards for technology and technology management.

Computer and Information Science Master of Science
Students are admitted to the program under the non-thesis option (Plan B). Students may apply for the thesis option (Plan A) on approval of a thesis outline by their adviser and the computer and information science (CISC) program's graduate committee.

The course of study is very flexible. Students complete a breadth requirement and additional courses suited to their backgrounds and career goals. The program director and faculty advisers work very closely with students to ensure that they achieve their educational goals through appropriate course selection.

Computer and information science students gain both breadth and an in-depth knowledge of their field.

Breadth Requirement
Computer and information science students experience the breadth of the field by completing one 3-credit course in each of the following four areas (12 total credits):

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>COSC 5500</td>
<td>Visual Analytics</td>
<td>3</td>
</tr>
<tr>
<td>COSC 5800</td>
<td>Principles of Database Systems</td>
<td></td>
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<tr>
<td>COSC 6510</td>
<td>Data Intelligence</td>
<td></td>
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<tr>
<td>COSC 5370</td>
<td>Internet of Things (IoT)</td>
<td></td>
</tr>
<tr>
<td>COSC 6355</td>
<td>Mobile Computing</td>
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</tbody>
</table>
An individual plan is developed by the student and approved by the computer and information science program director. No course may be counted toward satisfying both breadth requirement and a specialization. Electives may include courses on this list (beyond satisfying the breadth requirement). Six elective credits may be selected from other Marquette graduate courses outside the department, with the approval of the CISC program director.

**thesis OPTION (plan A)**

Students must supply an approved thesis outline to enter Plan A, the thesis option.

In Plan A, students must complete a total of 33 credit hours; however, students enrolled in the computing career change opportunity specialization take one additional 7-credit course for a total of 40 credit hours.

Course work includes 12 credit hours of breadth requirement courses, plus 15 credits of additional course work (15 credits of elective courses; or 15 credits of specialization courses). At least 12 credit hours of this course work must be taken at the 6000 level. Students must also complete a master’s thesis (COSC 6999 Master’s Thesis) for 6 credit hours and pass the oral examination concentrated on the thesis.

**Non-Thesis Option (Plan B)**

Students are automatically admitted into Plan B.

In Plan B, students must complete a total of 33 credit hours; however, students enrolled in the computing career change opportunity specialization take one additional 7-credit course for a total of 40 credit hours.

Course work includes 12 credit hours of breadth requirement courses, plus 21 credit hours of additional course work (21 credits of elective courses; or 15 credits of specialization courses and 6 credits of elective courses), for a total of 33 credit hours. At least 18 credit hours must be taken at the 6000 level.

**Specializations**

The master of science program in computer and information science offers four specializations: Information Assurance and Cyber Defense, AI and Analytics, the Computing Career Change Opportunity, and the Integrated Practicum (by permission only).

**Information Assurance and Cyber Defense (IACD)**

Students choosing the Information Assurance and Cyber Defense (IACD) specialization must complete the following courses for a total of 15 credit hours. *No course may be counted toward satisfying both breadth requirement and a specialization.* This specialization requires practical experience. In
this specialization, the professional project provides 0 credit hours for the leadership of a project in cybersecurity. Permission to undertake the specific project must come from the CISC program director.

<table>
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<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>COSC 5300</td>
<td>Network Design and Security</td>
<td>3</td>
</tr>
<tr>
<td>COSC 5360</td>
<td>Software and System Security</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6280</td>
<td>Advanced Computer Security</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6550</td>
<td>Introduction to Cybersecurity</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6560</td>
<td>Principles of Service Management and System Administration</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6998</td>
<td>Professional Project in Computer Science</td>
<td>0</td>
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<tr>
<td></td>
<td><strong>Total Credit Hours:</strong></td>
<td>15</td>
</tr>
</tbody>
</table>

**AI and Analytics (AIA)**

This specialization features course work related to trends in artificial intelligence and data analysis techniques used for business applications. Students choosing the AI and Analytics (AIA) specialization must complete the following courses for a total of 15 credit hours. No course may be counted toward satisfying both breadth requirement and a specialization.

Students in the AIA specialization must complete COSC 6510 Data Intelligence as the Data Management breadth requirement.

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<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>COSC 5600</td>
<td>Fundamentals of Artificial Intelligence</td>
<td>3</td>
</tr>
<tr>
<td>COSC 5500</td>
<td>Visual Analytics</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6060</td>
<td>Distributed and Cloud Computing</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6380</td>
<td>Big Data Systems</td>
<td>3</td>
</tr>
<tr>
<td>COSC 6520</td>
<td>Data Analytics</td>
<td>3</td>
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<tr>
<td></td>
<td><strong>Total Credit Hours:</strong></td>
<td>15</td>
</tr>
</tbody>
</table>

**Computing Career Change Opportunity**

This specialization is a workforce development initiative designed to move students from an underemployed status into a STEM career in computer and information science. It supports a career change for students who do not have the prerequisite knowledge and skills in programming, data structures and algorithms.

The specialization requires completion of foundations course COSC 6500 Foundations of Computing, supplying the computer and information science program prerequisites in a 7-credit graduate course. Other than COSC 6500 Foundations of Computing, at least 18 credit hours must be taken at the 6000 level, for a minimum total of 25 credits of 6000-level courses or above.

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<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>COSC 6500</td>
<td>Foundations of Computing</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td><strong>Additional Course Work options:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Graduate Elective courses (21 credits)</td>
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<tr>
<td></td>
<td>OR</td>
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<tr>
<td></td>
<td>Specialization courses (15 credits) plus Graduate Elective courses (6 credits)</td>
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</tr>
<tr>
<td></td>
<td><strong>Total Credit Hours:</strong></td>
<td>28</td>
</tr>
</tbody>
</table>

**INTEGRATED PRACTICUM**

Within Plan B, this specialization provides a unique opportunity for professional development. Students must indicate a desire to participate in the integrated practicum on their application to the program.

In the integrated practicum specialization, practical assignments in a working enterprise enhance the “learn from doing” opportunity beyond the typical assigned exercises, case studies, and student projects. The student adviser works with a participating employer and the student to ensure a tight integration between course work, career focus and work assignments. Work assignments are paired with courses to provide the simultaneous acquisition of foundational knowledge, professional skills and professional experience. The integration of course work and experience begins in the first term of the program and must continue through graduation.

This specialization requires completion of 6 credits of the integrated practicum (COSC 6965 Curriculum Integrated Practicum in Computing). Each 300-350 hours of integrated work experience earn one practicum credit. During the final practicum session, students may earn an additional practicum credit for a comprehensive paper demonstrating their competency in their primary career focus through accomplishments in their work assignments.
Additional Course Work options:

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<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>COSC 6965</td>
<td>Curriculum Integrated Practicum in Computing (multiple completions)</td>
<td>6</td>
</tr>
</tbody>
</table>

Total Credit Hours: 21

Additional considerations include:

- The student must maintain full-time graduate student status every term with the exception of the final term.
- Participation in this specialization is subject to the availability of work assignments and the qualifications of the student.
- The student must apply to the Master of Science in Computer and Information Science program and inform the director or their adviser of the intention to participate in the integrated practicum before their first term in the program.
- The student must apply to the participating employer and meet all of the requirements for an academically qualified position.
- If for any reason continuing work assignments are not available, the student can complete the degree program under Plan B's non-thesis course work option.

**Accelerated Bachelor's–Master's Degree Program**

The Department of Computer Science offers an accelerated degree program where eligible students may obtain both a bachelor's degree and the professional master of science degree in computer and information science in five years. Students are eligible to apply to this program as early as the final term of their sophomore year. Students wishing to participate in the five-year program must apply and be admitted to the program before their senior year.

Minimal criteria for application to the ADP include a GPA of at least 3.000 and the following course work: two terms of courses in programming; one course on data structures and algorithms.

Upon completion of the undergraduate degree, the ADP student must satisfy all of the requirements for the master of science degree in computer and information science and complete additional required graduate courses. The summer term may be taken immediately after the senior year or the following summer.

Within the undergraduate degree program, the student enrolls in the required programming and data structures courses and 12 graduate credits related to a computer and information science career. After completing the undergraduate program, there are three terms of graduate study. In these three terms, the student receives an additional 21 graduate credits, resulting in a total of 33 graduate credits.

**University Policies**

- Academic Censure - Graduate School (https://bulletin.marquette.edu/policies/academic-censure/graduate/)
- Academic Integrity (https://bulletin.marquette.edu/policies/academic-integrity/)
- Academic Misconduct (https://bulletin.marquette.edu/policies/academic-misconduct-policy/)
- Academic Program Definitions (https://bulletin.marquette.edu/policies/academic-programs-defined/)
- Accelerated Degree Programs (https://bulletin.marquette.edu/policies/accelerated-degree-programs/)
- Attendance - Graduate School (https://bulletin.marquette.edu/policies/attendance/graduate/)
- Awarding Diplomas and Certificates (https://bulletin.marquette.edu/policies/awarding-diplomas-certificates/)
- Background Checks, Drug Testing (https://bulletin.marquette.edu/policies/background-checks-drug-testing/)
- Class Rank (https://bulletin.marquette.edu/policies/class-rank/)
- Commencement (https://bulletin.marquette.edu/policies/commencement/)
- Course Levels (https://bulletin.marquette.edu/policies/course-levels/)
- Credit Hour (https://bulletin.marquette.edu/policies/credit/)
- Credit Load - Graduate School (https://bulletin.marquette.edu/policies/credit-load/graduate/)
- Faculty Grading (https://bulletin.marquette.edu/policies/faculty-grading/)
- Family Education Rights and Privacy Act-FERPA (https://bulletin.marquette.edu/policies/ferpa/)
- Grade Appeals (https://bulletin.marquette.edu/policies/grade-appeals/)
- Grading System - Graduate School and Graduate School of Management (https://bulletin.marquette.edu/policies/grading-system/graduate-management/)
- Graduation - Graduate School (https://bulletin.marquette.edu/policies/graduation/graduate/)
- Immunization and Tuberculosis Screening Requirements (https://bulletin.marquette.edu/policies/immunization-and-tuberculosis-screening/)
COSC 5290 Real-Time and Embedded Systems (3 credits)
Focuses on event-driven programming, real-time scheduling, and synchronization; worst-case execution time analysis and deadline analysis; real-time operating systems and real-time programming languages.
Level of Study: Graduate
Last four terms offered: 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205290)
COSC 5300  Network Design and Security  (3-4 credits)
Focuses on the design and protocols of the upper layers of the Internet architecture, including the TCP/IP protocol suite, packet switching and routing, network programming and applications. Emphasizes related security attacks and defenses, including DNSSEC, TSL, IPsec and the BGP PKI protections. Taught as a lecture only or as a lecture with lab component.
Level of Study: Graduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205300)

COSC 5360  Software and System Security  (3 credits)
Fosters comprehension of cybersecurity foundations such as cryptography, operating system security, threat modeling, and secure programming. Develops passion for cybersecurity essential to performance of professional roles as developers, engineers, and managers.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205360)

COSC 5370  Internet of Things (IoT)  (3 credits)
Topics include the definition of IoT, trends in the adoption of IoT, the importance of the IoT in society, the current components of typical IoT devices and trends for the future. Focuses on IoT design considerations, constraints, and interfacing between the physical world and the device. Students are presented with design trade-offs between hardware and software, technologies behind the Internet of Things – RFID, NFC, Wireless networks, WSN, RTLS, GPS, agents, multagent systems, IoT in retail, NFC applications for the IoT, and IoT in healthcare.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2023 Summer Term, 2022 Summer Term, 2021 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205370)

COSC 5400  Compiler Construction  (3 credits)
Lexical analysis, parsing, code generation and optimization. Includes theoretical foundations and the practical concerns of implementation.
Level of Study: Graduate
Last four terms offered: 2022 Fall Term, 2020 Fall Term, 2019 Spring Term, 2017 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205400)

COSC 5500  Visual Analytics  (3 credits)
Focuses on developing data products using the Javascript/D3 framework by combining concepts from human-computer interaction, visualization and design. Also focuses on model visualization, interpretation, A/B testing and design thinking.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205500)

COSC 5550  Social and Collaborative Computing  (3 credits)
Introduces Social Computing and Computer-Supported Cooperative Work (CSCW). Field includes theory, technology and study of computing systems that support groups of users and facilitate collaboration. Example applications and case studies include email, social networking sites, peer production, crowdsourcing, calendars, scheduling and meeting apps, online dating sites, multiplayer games, discussion forums, instant messaging, collaborative editors and analysis tools.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205550)

COSC 5600  Fundamentals of Artificial Intelligence  (3 credits)
An introduction to the broad field of artificial intelligence. Topics include problem solving by searching, knowledge representation, reasoning, planning, decision making, learning, perception and language processing.
Level of Study: Graduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205600)

COSC 5610  Data Mining  (3 credits)
Techniques for extracting and evaluating patterns from large databases. Introduction to knowledge discovery process. Fundamental tasks including classification, prediction, clustering, association analysis, summarization and discrimination. Basic techniques including decision trees, neural networks, statistics, partitioning clustering and hierarchical clustering.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205610)
COSC 5800  Principles of Database Systems  (3 credits)
Topics include database concepts and architecture, data modeling, formal query languages such as relational algebra, commercial query language SQL, database access from application programs and a brief examination of advanced concepts including transactions, distributed databases, security and XML.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205800)

COSC 5860  Component-Based Software Construction  (3 credits)
Introduction to software components in the context of the object-oriented paradigm. Component development, component selection and adaptation/customization, component deployment and assembly/integration, and system architecture. Industry standards such as JavaBeans, CORBA Component Model, and Microsoft COM/DOM/COM+.
Level of Study: Graduate
Last four terms offered: 2011 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205860)

COSC 5931  Topics in Computer Science  (1-3 credits)
Topics selected from one of the various branches of computer science. Specific topics to be announced in the Schedule of Classes.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2023 Fall Term, 2023 Summer Term, 2023 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%205931)

COSC 6050  Elements of Software Development  (3 credits)
Students explore the software design and development processes through a term project. Concepts covered include: requirements gathering and analysis, mapping requirements to a design, sound coding and documentation practices, configuration management, testing and quality assurance, system deployment and maintenance.
Prerequisite: Programming in a high-level language, knowledge in data structures such as stacks, recursion, queues, trees and graphs.
Level of Study: Graduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206050)

COSC 6051  Professional Software Engineering 1  (3 credits)
Covers software engineering topics typically including: the software development life cycle (SDLC), development methodologies, software quality overview, configuration management, designing for risks and fault tolerance, languages and design, object-oriented programming, observational research and prototyping, requirements, software architectures, operating systems design and real time systems. Offered at General Electric facilities. As this course extends beyond the Marquette term, students receive the grade of IC initially. The IC grade converts to an A-F grade at the completion of the course.
Prerequisite: GE employee in the Software Edison program.
Level of Study: Graduate
Last four terms offered: 2020 Fall Term, 2019 Fall Term, 2018 Spring Term, 2017 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206051)

COSC 6052  Professional Software Engineering 2  (3 credits)
Covers software engineering topics typically including: systems and communication networks, security and distributed systems, interoperability and standards, design for "ility" (e.g., usability and reliability) and performance, design for parallel processing, embedded systems hardware for software developers, embedded systems software, software design patterns and algorithms. Offered at General Electric facilities. As this course extends beyond the Marquette term, students receive the grade of IC initially. The IC grade converts to an A-F grade at the completion of the course.
Prerequisite: GE employee in the Software Edison program.
Level of Study: Graduate
Last four terms offered: 2020 Fall Term, 2019 Fall Term, 2018 Spring Term, 2017 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206052)

COSC 6053  Professional Software Engineering 3  (3 credits)
Covers software engineering topics typically including: database systems, decision science, data quality and analytics, user interface design, design for globalization, debugging and troubleshooting, approach, method, implementation and emerging software technologies. Offered at General Electric facilities. As this course extends beyond the Marquette term, students receive the grade of IC initially. The IC grade converts to an A-F grade at the completion of the course.
Prerequisite: GE employee in the Software Edison program.
Level of Study: Graduate
Last four terms offered: 2020 Fall Term, 2019 Fall Term, 2018 Fall Term, 2018 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206053)
COSC 6054  Professional Software Engineering 4 (3 credits)
Covers design topics related to system design with embedded computing. Topics typically include: design of controls, design for low cost, design for serviceability, design for usability, design for reliability, program management, innovation, requirements management and design thinking. Offered at General Electric facilities. As this course extends beyond the Marquette term, students receive the grade of IC initially. The IC grade converts to an A-F grade at the completion of the course.
Prerequisite: GE employee in the Software Edison program.
Level of Study: Graduate
Last four terms offered: 2020 Fall Term, 2019 Fall Term, 2018 Fall Term, 2017 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206054)

COSC 6055  Software Quality Assurance (3 credits)
Provides a perspective on people, organizations, controls, processes and tools that collectively influence the success of a Software Quality Assurance (SQA) strategy. Discussion topics include quality approaches as they apply to: requirements, design, release, configuration management, testing, defect management, operations and support. Topics are discussed in the context of a traditional development approach (waterfall, CMMI) and more contemporary models driven by lean and agile practices. Covers considerations specific to implementing an SQA approach within a regulated setting. Approach emphasizes a hands-on view of SQA, thereby providing realistic takeaways to practice in a professional career.
Level of Study: Graduate
Last four terms offered: 2021 Spring Term, 2020 Spring Term, 2019 Spring Term, 2018 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206055)

COSC 6060  Distributed and Cloud Computing (3 credits)
Students use and develop software for distributed and cloud computing systems. Topics include job submission and management, tools distributed software development, approaches for implementing distributed and cloud computation, virtualization, public cloud platforms, cloud data management, cloud security and privacy.
Prerequisite: COSC 3100 or equiv.
Level of Study: Graduate
Last four terms offered: 2023 Spring Term, 2022 Spring Term, 2021 Spring Term, 2020 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206060)

COSC 6090  Research Methods/Professional Development (1 credits)
Designed to introduce the process of research and communication of research in computer science, including presentation and publication of research, preparation of grant proposals, and ethical considerations. May be repeated.
Level of Study: Graduate
Last four terms offered: 2022 Fall Term, 2021 Fall Term, 2021 Spring Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206090)

COSC 6260  Advanced Algorithms (3 credits)
Covers advanced paradigms for the design and analysis of efficient algorithms. Emphasizes fundamental algorithms and advanced methods of algorithmic design, analysis, and implementation. Domains include: string algorithms, network optimization, parallel algorithms, computational geometry, external memory and streaming algorithms, and advanced data structures.
Level of Study: Graduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206260)

COSC 6270  Advanced Operating Systems (3 credits)
Fundamental concepts of operating systems including kernel data structures; process control and scheduling; interprocess communication and synchronization; virtual memory and memory management; mass storage systems and device control; protection and security; and protection and virtualization; evaluation and prediction of performance. Students are expected to spend at least three hours per week gaining hands-on experience in using and modifying a small operating system.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2020 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206270)

COSC 6280  Advanced Computer Security (3 credits)
Symmetric key and public key cryptography, hash functions, random numbers and cryptanalysis; authentication and authorization, password-based security, ACLs and capabilities, covert channels, security models, firewalls and intrusion detection systems; authentication protocols, session keys, SSH, SSL, IPSec, Kerberos, WEP, and GSM; flaws and malware, buffer overflows, viruses and worms, malware detection, software reverse engineering, digital rights management, secure software development and operating systems security; fundamentals about bitcoin and cryptocurrency technologies. Students write programs for assignments using the C programming language.
Level of Study: Graduate
Last four terms offered: 2023 Fall Term, 2023 Spring Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206280)
COSC 6330  Advanced Machine Learning (3 credits)
Provides a graduate-level introduction to machine learning and statistical pattern recognition and in-depth coverage of new and advanced methods in machine learning, as well as their underlying theory. Emphasizes approaches with practical relevance and discusses a number of recent applications of machine learning, such as data mining, computer vision, robotics, text and web data processing. An open research project is a major part of the course.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206330)

COSC 6340 Component Architecture (3 credits)
Focuses on designing and implementing software components, and streamlining the translation from business intent into realized application behavior in a practical hands-on, business-based environment. Introduces service-oriented architecture (SOA) and principles such as loose coupling, abstraction, reusability, autonomy, statelessness, discoverability, interoperability and compositability.
Level of Study: Graduate
Last four terms offered: 2016 Spring Term, 2011 Fall Term, 2010 Spring Term, 2008 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206340)

COSC 6345 Mobile Health (mHealth) (3 credits)
Offers a multidisciplinary overview of the emerging technologies used in mobile health (mHealth). Research and innovations in this area promise solutions to the need for broader access to affordable and effective healthcare by enabling consumers and their caregivers to take charge of their health and well-being. mHealth is the provision of health information and services using sensor data via mobile phones and tablets. Students develop foundational knowledge of understanding the behaviors, different data models, security and privacy issues.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2022 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206345)

COSC 6350 Distributed Computing (3 credits)
Introduces a broad spectrum of topics encompassing system architecture, software abstractions, distributed algorithms and issues pertaining to distributed environments such as replication, consistency, fault tolerance, transactions and security.
Level of Study: Graduate
Last four terms offered: 2014 Spring Term, 2012 Spring Term, 2009 Spring Term, 2007 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206350)

COSC 6355 Mobile Computing (3 credits)
Focuses on the fundamentals of mobile computing, challenges in mobile computing, mobility management and mobile data management. Also focuses on context awareness and wireless communications, ubiquity of wireless communication technologies and standards, seamless access network services and resources from anywhere, at anytime, middleware for mobile computing, operation systems, programming languages, network protocols and security aspects of mobile computing. Explores concepts in sensor networks, including operating systems, programming languages, network protocols and programming models.
Prerequisite: COSC 2100 or equiv.
Level of Study: Graduate
Last four terms offered: 2023 Spring Term, 2021 Summer Term, 2020 Summer Term, 2019 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206355)

COSC 6360 Enterprise Architecture (3 credits)
Focuses on key topics and concepts that represent enterprise architecture (EA). Addresses the people, process and technology elements of EA from both a business and technical perspective. Explores the background, history, planning, governing, maintaining and common methodologies associated with EA. Prototypes some of the technology used in enterprises today to gain a better understanding of how information is represented, systems are integrated and standards are put into practice.
Level of Study: Graduate
Last four terms offered: 2023 Fall Term, 2021 Fall Term, 2020 Fall Term, 2019 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206360)

COSC 6375 Web Technologies (3 credits)
Exposes students to design and architectural principles in developing web applications. Focuses on the client side, middleware and service layer of web applications. Topics range from HTML, JavaScript, JQuery, Java Servlets, MVC Design Pattern, Java Spring MVC, SQL, JDBC, Hibernate, AngularJS and Cloud Computing.
Level of Study: Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206375)

COSC 6380 Big Data Systems (3 credits)
Focuses on newer, advanced database techniques in the areas of Big Data, NoSQL, Hadoop and Apache Spark. Covers main NoSQL data management topics such as document databases, key-value stores and graph databases.
Prerequisite: Database Systems or equiv.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206380)
COSC 6390 Professional Seminar in Computing (1 credits)
Topic to be chosen each term from among issues important to all professionals in computing. All students specifically in the computing program are expected to participate for the fall and spring terms, and one of the two summer terms. S/U grade assessment.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206390)

COSC 6500 Foundations of Computing (6-7 credits)
Prerequisite: Basic knowledge of scripting, operating systems and services, incident management, change management, security, monitoring and analysis of operations. systems for servers, network configuration, system components, networked systems, host management, user management, configuration of servers and performing rudimentary tasks of a system administrator using virtual machine environments. Foundation topics include: cryptography, popular operating management and explores how the principles of system administration are derived from concepts of delivering quality services. Lab exercises
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206500)

COSC 6510 Data Intelligence (3 credits)
Foundational topics in data intelligence. Includes properties and benefits for data intelligence and methodology for the development of data intelligence solutions. Examines technology employed for managing data and creating visualizations and dashboards. Topics include developing a business case, evaluating performance and managing data. Presents overview of data architectures commonly used in data intelligence solutions and includes exercises using common techniques for prediction and time series analysis.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206510)

COSC 6520 Data Analytics (3 credits)
Foundational topics in the analysis of data. Includes methodology for the development of data analytics systems. Examines technology employed for data analytics in a variety of industry segments and the benefits derived from data analytics. Foundations of text and data mining techniques commonly used for classification, clustering and prediction. Students are presented techniques for developing a business case, evaluating predictive performance and managing data. Includes exercises using analytic technology and a project to apply analytics to a customer application. Students without programming experience are advised to complete COSC 6510 Data Intelligence before attempting COSC 6520.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206520)

COSC 6530 Concepts of Data Warehousing (3 credits)
Foundational topics in the design, implementation and administration. The role of data warehouse in supporting decision support systems (DSS), business intelligence and business analytics.
Level of Study: Graduate
Last four terms offered: 2022 Fall Term, 2021 Fall Term, 2020 Fall Term, 2019 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206530)

COSC 6550 Introduction to Cybersecurity (3 credits)
Foundations of various cybersecurity frameworks and methods for applying them to different types of organizations. Includes cyber threat environment, along with methods, tools and techniques that can help mitigate vulnerabilities and reduce risks to an organization.
Level of Study: Graduate
Last four terms offered: 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206550)

COSC 6560 Principles of Service Management and System Administration (3 credits)
Prerequisite: Basic knowledge of scripting, operating systems and services.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206560)
COSC 6570 Data at Scale (3 credits)
Combines ideas from parallel databases, distributed systems and programming languages to analyze data at scale. Relevant technologies are introduced and taught in an accessible and inclusive way. Some examples include cloud computing, SQL and NoSQL databases, MapReduce ecosystem, Spark and its contemporaries and graph databases.
Level of Study: Graduate
Last four terms offered: 2023 Fall Term, 2023 Spring Term, 2022 Spring Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206570)

COSC 6580 Data Security and Privacy (3 credits)
Focuses on fundamental and advanced topics in data security and privacy, including differential privacy, secure multi-party computation, homomorphic encryption, data perturbation, data anonymization, security and privacy in AI, location privacy, and social network privacy. Students also learn practical skills via projects.
Prerequisite: Basic knowledge on statistics, databases, machine learning/data mining, and distributed systems.
Level of Study: Graduate
Last four terms offered: 2022 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206580)

COSC 6931 Topics in Computer Science (3 credits)
Topics vary. Students may enroll more than once as the subject matter changes.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2023 Fall Term, 2023 Summer Term, 2023 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206931)

COSC 6964 Practicum for Research and Development in Computing (3-6 credits)
S/U grade assessment.
Prerequisite: 3.00 MU GPA; must be enrolled in Plan B option of the M.S. in computing program and have completed at least 15 credit hours earned in graduate (6000-level) courses. Available only to full-time students. Cons. of the computing dir. of graduate studies or cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2024 Spring Term, 2023 Summer Term, 2022 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206964)

COSC 6965 Curriculum Integrated Practicum in Computing (1-2 credits)
Involves practical application of the knowledge and skills being studied concurrently, and previously studied, in other course work for computing professionals.
Prerequisite: Admission to the COMP program's integrated practicum option; cons. of the computing dir. of graduate studies or cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206965)

COSC 6974 Practicum for Research and Development in Computer Science (1-6 credits)
Students in the MS in Computing program should be registering for COSC 6964, Practicum for Research and Development in Computing. S/U grade assessment.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206974)

COSC 6975 Curriculum Integrated Practicum in Computer Science (0 credits)
Involves advancing practical research and development of the computer science doctoral program student.
Prerequisite: Admitted to the COSC-PHD prog.; cons. of the co-op chair or grad. chair or dept. chair.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206975)
COSC 6995 Independent Study in Computer Science (1-6 credits)
An in-depth study on a topic or subject matter usually not offered in the established curriculum with faculty and independent of the classroom setting.
Prerequisite: Cons. of instr. and cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206995)

COSC 6998 Professional Project in Computer Science (0 credits)
SNC/UNC grade assessment.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2024 Spring Term, 2023 Spring Term, 2022 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206998)

COSC 6999 Master's Thesis (1-6 credits)
S/U grade assessment.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%206999)

COSC 8995 Independent Study in Computer Science (1-3 credits)
A doctorate level in-depth research on a topic or subject matter usually not offered in the established curriculum with faculty and independent of the classroom setting.
Prerequisite: Cons. of instr. and cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%208995)

COSC 8999 Doctoral Dissertation (1-12 credits)
S/U grade assessment.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%208999)

COSC 9970 Graduate Standing Continuation: Less than Half-Time (0 credits)
Fee. SNC/UNC grade assessment. Designated as less than half-time status only, cannot be used in conjunction with other courses, and does not qualify students for financial aid or loan deferment.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209970)

COSC 9974 Graduate Fellowship: Full-Time (0 credits)
Fee. SNC/UNC grade assessment. Designated as full-time status. If a student is already registered in other courses full time, this continuation course is not needed.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209974)

COSC 9975 Graduate Assistant Teaching: Full-Time (0 credits)
Fee. SNC/UNC grade assessment. Designated as full-time status. If a student is already registered in other courses full time, this continuation course is not needed.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209975)

COSC 9976 Graduate Assistant Research: Full-Time (0 credits)
Fee. SNC/UNC grade assessment. Designated as full-time status. If a student is already registered in other courses full time, this continuation course is not needed.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2021 Spring Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209976)
COSC 9987 Doctoral Qualifying Examination Preparation: Less than Half-Time (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of less than half-time status. Requires that the student is working less than 12 hours per week toward their doctoral qualifying exam.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2021 Spring Term, 2020 Fall Term, 2019 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209987)

COSC 9988 Doctoral Qualifying Examination Preparation: Half-Time (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of half-time status. Requires that the student is working more than 12 to less than 20 hours per week toward their doctoral qualifying exam. May be taken in conjunction with credit-bearing or other non-credit courses to result in the status indicated, as deemed appropriate by the department.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2023 Fall Term, 2022 Spring Term, 2021 Fall Term, 2021 Spring Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209988)

COSC 9989 Doctoral Qualifying Examination Preparation: Full-Time (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of full-time status. Requires that the student is working 20 hours or more per week toward their doctoral qualifying exam. May be taken in conjunction with credit-bearing or other non-credit courses to result in the status indicated, as deemed appropriate by the department.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209989)

COSC 9991 Professional Project Continuation: Less than Half-Time (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of less than half-time status. Requires that the student is working less than 12 hours per week on their professional project. Any professional project credits required for the degree should be completed before registering for non-credit Professional Project Continuation.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209991)

COSC 9992 Professional Project Continuation: Half-Time (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of half-time status. Requires that the student is working more than 12 to less than 20 hours per week on their professional project. Any project credits required for the degree should be completed before registering for non-credit Professional Project Continuation.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209992)

COSC 9993 Professional Project Continuation: Full-Time (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of full-time status. Requires that the student is working 20 hours or more per week on their professional project. Any professional project credits required for the degree should be completed before registering for non-credit Professional Project Continuation.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209993)

COSC 9994 Master's Thesis Continuation: Less than Half-Time (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of less than half-time status. Requires that the student is working less than 12 hours per week on their master's thesis. All six thesis credits required for the degree should be completed before registering for non-credit Master's Thesis Continuation.
Prerequisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2020 Summer Term, 2019 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209994)
COSC 9995  Master's Thesis Continuation: Half-Time  (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of half-time status. Requires that the student is working more than 12 to less than 20 hours per week on their master's thesis. All six thesis credits required for the degree should be completed before registering for non-credit Master's Thesis Continuation.
Pre requisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2023 Summer Term, 2022 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209995)

COSC 9996  Master's Thesis Continuation: Full-Time  (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of full-time status. Requires that the student is working more than 20 hours per week on their master's thesis. All six thesis credits required for the degree should be completed before registering for non-credit Master's Thesis Continuation.
Pre requisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2022 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209996)

COSC 9997  Doctoral Dissertation Continuation: Less than Half-Time  (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of less than half-time status. Requires that the student is working less than 12 hours per week on their doctoral dissertation. All 12 dissertation credits required for the degree should be completed before registering for non-credit Doctoral Dissertation Continuation.
Pre requisite: Cons. of dept. ch.
Level of Study: Graduate
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209997)

COSC 9998  Doctoral Dissertation Continuation: Half-Time  (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of half-time status. Requires that the student is working more than 12 to less than 20 hours per week on their doctoral dissertation. All 12 dissertation credits required for the degree should be completed before registering for non-credit Doctoral Dissertation Continuation.
Pre requisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Spring Term, 2021 Fall Term, 2020 Fall Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209998)

COSC 9999  Doctoral Dissertation Continuation: Full-Time  (0 credits)
Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of full-time status. Requires that the student is working 20 hours or more per week on their doctoral dissertation. All 12 dissertation credits required for the degree should be completed before registering for non-credit Doctoral Dissertation Continuation.
Pre requisite: Cons. of dept. ch.
Level of Study: Graduate
Last four terms offered: 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Summer Term
Schedule of Classes (https://bulletin.marquette.edu/class-search/?details&code=COSC%209999)