

## MASTER OF SCIENCE IN COMPUTER SCIENCE AND INFORMATION SYSTEMS

The Department of Computer Science in the College of Arts and Sciences and the Department of Information Systems and Operations Management in the Cameron School of Business offer a joint program of study leading to the Master of Science degree in computer science and information systems. This interdisciplinary program is targeted primarily at students who received undergraduate degrees in computer science or information systems and at computer professionals with equivalent academic preparation. A secondary audience for the program is students whose background is in related areas such as business, mathematics, and electrical engineering, or working professionals seeking to migrate to the information technology arena. The interdisciplinary nature of this program provides a unique balance of advanced scientific knowledge, commonly found in the computer science field, and the development of systems and solutions, applied in a business environment, usually considered the focus of the information systems field. This unique blend will provide a foundation for information technology professionals to have a broader perspective of the rapidly expanding and evolving science of technology and how it can be managed and leveraged to support and further commerce and trade activities.

### Admission Requirements

Applicants seeking admission to the graduate program in computer science and information systems are required to submit the following to the Graduate School:

1. An application for graduate admission.
2. Official transcripts of all college work (undergraduate and graduate).
3. Certificates of training in computer science/information systems if applicable.
4. Official scores on the Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE). Scores more than five years old will not be accepted.
5. Three recommendations from individuals in professionally relevant fields.
6. Applicant's resume and a letter of interest.
7. Additional materials may be required (e.g., TOEFL or IELTS scores for international students).

Each applicant must have a strong overall academic record and have successfully completed the undergraduate level prerequisites in computer science and information systems courses or their equivalent: two programming courses, and a course in each of data structures, database, software engineering, analysis and design or data communications or networking, financial accounting, marketing, finance, and management. Deficiencies in a student's undergraduate preparation will be ascertained by the MSCSIS Advisory Committee. Placement tests may be administered to incoming students at the discretion of the advisory committee to assist with the evaluation of deficiencies.

Persons entering the program must have completed a basic core of computer science and information systems. Professional experience may be accepted for some of the prerequisite coursework. Professional experience and/or coursework from other institutions must be approved by the MSCSIS Advisory Committee. Professional experience and/or technical certifications will be evaluated on a case by case basis for any prerequisite substitution.

Admissions decisions are based upon the examination of several factors, and where other indicators of success warrant, individuals who fall below the established criteria may still be considered for admission.

### Degree Requirements

1. Programs leading to the Master of Science degree require a minimum of 36 semester hours of graduate study. This includes six required core courses (18 hours) providing a mix of theoretical underpinning, technical skills, and information technology perspectives and elective courses (12 to 15 hours) that provide the opportunity for additional study in a variety of areas to be determined by the student and his/her advisory committee. A research project (3 hours), or a thesis (6 hours), will serve as the capstone experience.
2. No more than 9 credit hours from those courses cross listed as 400/500 may be applied toward the degree. Graduate courses offered by other departments may be approved by the student's advisory committee. A maximum of six hours of credit may be transferred from another accredited institution. Grades earned on transfer work must be equivalent to a "B" or better, and courses must be acceptable to the student's advisory committee. A minimum of 30 semester hours of graduate study must be completed in residence.
3. A student must have no less than a 3.0 GPA on all graduate-level courses.
4. The student must successfully complete an oral defense.
5. The program shall be completed within five years of the date of first registration for graduate study.
6. A research project (3 hours), or a thesis (6 hours), will serve as a capstone experience.
7. No more than 9 credit hours from the list CSC 591, MIS 591, CSC 595, MIS 595, CSC 598, and MIS 598 may be applied toward the degree.

**Degree Options**

A student may select among two options:

Option	Program Coursework	Research Project	Thesis
1	33 hours	3 hours	
2	30 hours		6 hours

**Option 1 – Research Project**

This option requires at least 36 semester hours of graduate credit, with three credit hours for the project (CSC 594 or MIS 594). Under this option, the student is required to complete a three hour research project under the direction of a graduate advisory committee. This project could involve the development of software, work on a project (potentially part of a team), independent research, or some other scholarly pursuit. The outcome includes a technical paper written by the student and an oral defense acceptable to the student's advisory committee. In the oral defense, the student is responsible for the domain of the research project as well as the program coursework.

**Option 2 – Thesis**

This option requires at least 36 semester hours of graduate credit, with six credit hours for the thesis (CSC 599 or MIS 599). Each student must present and defend a thesis, based on original research, acceptable to the student's advisory committee, prior to graduation. In the oral defense, the student is responsible for the domain of the research effort as well as the program coursework. The thesis defense is open to the public.

**Required Core Courses**

CSC 532	Design and Analysis of Algorithms I	(3)
MIS 534	Information Security Management	(3)
CSC 544	Network Programming	(3)
CSC 550	Software Engineering	(3)
MIS 555	Database Management Systems	(3)
MIS 565	Analysis, Modeling and Design	(3)

**GRADUATE PROGRAM IN COMPUTER SCIENCE AND INFORMATION SYSTEMS**  
**Course Descriptions**

**CSC 500. Concepts in Computer Science (6)** Prerequisite: consent of instructor. An accelerated introduction to fundamental concepts in computer science. Topics include object-oriented programming; data structures; program control structures; introduction to algorithm design and analysis and software engineering concepts.

**CSC 515. (415) Artificial Intelligence (3)** Prerequisite: CSC 332 or equivalent. Introduction to key concepts and applications of artificial intelligence. Knowledge representation; state space searching; heuristic search; expert systems. Biologically – inspired computing techniques such as neural networks, fuzzy logic and genetic algorithms. Implementation of concepts and techniques.

**CSC 516. Introduction to Biologically Inspired Computing (3)** Prerequisite: CSC 415, CSC 515 or consent of instructor. Theory and application of computing paradigms that operate analogously to biological systems. Topics such as machine learning, artificial neural networks, genetic algorithms, fuzzy systems, swarm intelligent systems, and hybrids of these systems. Attention will be given to problem representation and emerging models of computation.

**CSC 517. Symbolic Artificial Intelligence (3)** Exploration of key concepts and applications of symbolic artificial intelligence such as knowledge representation, search strategies, game theory, heuristic search, knowledge engineering, expert systems, reasoning, learning, natural language processing. Implementation of concepts and techniques.

**CSC 520. Digital Image Processing (3)** Prerequisite: CSC 340 or equivalent. This course introduces the methods and theory of digital image processing beginning with image representations, storage formats, and data structures. Students develop tools for reading image data, determining image properties and performing common point, local, and global transforms. The course also covers data compression, digital watermarking, morphological processing, and steganography.

**CSC 521. (421) Computer Gaming (3)** Prerequisites: ART/CSC/FST 320, CSC 340, and CSC 370. Topics related to the design and implementation of computer games are covered, including design, modeling, and animation of meshes for game characters and environments, scene and object representation, graphics pipeline, collision detections, picking, graphics optimization, and other issues such as basic game physics and artificial intelligence for games. Animations are created using advanced 3D software and code modifications to a game engine will be made.

**CSC 522. Performance Evaluation of Computer Systems (3)** Prerequisite: STT 215, MAT 162, and CSC 221. Modeling and evaluation of computer systems. Probability spaces and probability calculus, random variables and their distribution functions, the calculus of expectations. Markov chains; birth-death processes; Poisson processes; single queue; network of queues and their simulation. System simulation for performance prediction. Modeling concurrent processes and the resources they share.

**CSC 525. (425) (MAT 525/425) Numerical Analysis (3)** Prerequisite: Undergraduate linear algebra, differential equations, and elementary numerical methods. Introduction to the theoretical foundations of numerical algorithms. Solution of linear systems by direct methods; least squares, minimax, and spline approximation; polynomial interpolation; numerical integration and differentiation; solution of nonlinear equations; initial value problems in ordinary differential equations; error analysis. Certain algorithms are selected for programming.

**CSC 532. Design and Analysis of Algorithms I (3)** Prerequisite: CSC 332 or equivalent. Theory of the design of efficient computer algorithms. Algorithms for sorting, searching, pattern matching, and polynomial arithmetic, cryptography, as well as study of greedy algorithms, graph algorithms.

**CSC 533. Design and Analysis of Algorithms II (3)** Prerequisite: CSC 532. Theory of the design of efficient computer algorithms. Amortized analysis, sorting networks, matrix operations. Polynomials and FFT, number-theoretic algorithms, and computational geometry.

**CSC 537. (437) Parallel Computing (3)** Prerequisite: CSC 340. Implementation of scientific algorithms in parallel. Use of shared-memory, distributed-memory, and multicore technologies. Study of techniques for improved performance and issues related to speedup and slowdown.

**CSC 540. Advanced Scientific Computing (3)** Prerequisite: CSC 340 or equivalent. This course introduces the underlying theory, design, implementation, application, and analysis of numerical algorithms fundamental to scientific computation. Topics include Fourier and wavelet transforms spectral analysis, energy distributions, convolution, correlation, windowed transforms, and filtering. Other topics include constrained nonlinear and combinatorial optimization, curve fitting, data mining, clustering, and fuzzy logic.

**CSC 544. Network Programming (3)** Prerequisite: CSC 344 or MIS 416 or equivalent. Implementation of network and distributed programming concepts using C, C++, or JAVA on Unix or Windows platforms. Networking programming interfaces, security, management, design and applications. Hands on experience with network components. Students plan, configure, install, diagnose, performance tune, operate and manage state-of-the-art computer networks, internetworking devices and protocols.

**CSC 546. (446) Grid Computing (3)** Prerequisite: CSC 344 or CSC 332. Grid computing software components, standards, web services, security mechanisms, schedulers and resource brokers, workflow editors, grid portals, grid computing applications.

**CSC 550. Software Engineering (3)** Prerequisite: CSC 450 or equivalent. An introduction to software life cycle models; size estimation; cost and schedule estimation; project management; risk management; formal technical reviews; analysis, design, coding and testing methods; configuration management and change control; and software reliability estimation. Emphasis on large development projects. Individual project following good software engineering practices required during the semester.

**CSC 553. Object-Oriented Analysis and Design (3)** Prerequisite: CSC 332 or equivalent. An exploration of object-oriented design and software construction. Topics in object-oriented analysis and programming: classes, methods, messages, inheritance, static and dynamic binding, polymorphism, templates, design methodologies, class libraries, and software reuse. Substantial object-oriented software project required.

**CSC 564. (MIS 564) Computer and Network Security (3)** Prerequisite: CSC 544. An in-depth coverage of network security technologies, network design implications, and security planning for an organization's computer network. Procedures for the identification, preservation and extraction of electronic evidence. Auditing and investigation of network and host intrusions. Forensic tools and resources for systems administrators and information system security officers.

**CSC 570. Real-Time Graphics (3)** Prerequisites: CSC 370 or equivalent. Theory and implementation of high-performance computer graphics. Applications from virtual reality, training, and entertainment. Graphics hardware. High-fidelity graphics. Introduction to computational geometry.

**CSC 572. Scientific Visualization (3)** Prerequisite: CSC 332 or equivalent, senior or graduate standing in a science program, or permission of instructor. The application of computer graphics techniques to scientific, medical, engineering, and business data. Understanding the requirements placed on data display by physics, physiology, and psychology.

**CSC 577. Pattern Recognition (3)** Prerequisite: CSC 340 or equivalent. This course introduces pattern recognition methods and theory using conventional statistical approaches, neural networks, fuzzy logic, support vectors, and linear principal component analysis (PCA). The course also presents methods for non-linear PCA, clustering, and feature extraction. Students implement algorithms; apply methods to selected problems, and to document findings.

**CSC 587. (MIS 587) Systems Simulation (3)** Prerequisite: QMM 280, STT 215, or equivalent. Study of the techniques and applications of computer simulation of systems. Students will learn to plan simulation studies, program them in a simulation language, perform the study, and analyze the results with statistical rigor. Also covered are random number generation, input distribution selection, generating random variables, and variance reduction techniques.

**CSC 591. (MIS 591) Directed Independent Study (1-6)** Prerequisite: Permission of instructor. Involves investigation under faculty supervision beyond what is offered in existing courses.

**CSC 592. (MIS 592) Topics in Computing (1-6)** Prerequisite: Permission of instructor. Topics in computing of current interest not covered in existing courses.

**CSC 594. (MIS 594) Research Project (1-6)** Prerequisite: Permission of instructor. Focused study of a research topic in the practical application of computer science or information systems under the guidance of a faculty member. Topics are selected by the student with faculty and graduate coordinator approval. Written analysis and oral presentation of the project is required.

**CSC 595. (MIS 595) Research Seminar (1-6)** Prerequisite: Permission of instructor. Research and discussion of selected topics in computer science or information systems. Oral presentation required.

**CSC 598. (MIS 598) Internship (1-6)** Prerequisite: Overall GPA of at least 3.0. Academic training and practical experience through work in a private company or public agency. Faculty supervision and evaluation of all study and on-site activity. Students must secure permission of the graduate coordinator.

**CSC 599. (MIS 599) Thesis (1-6)**

**MIS 513. Information Analysis and Management (3)** Prerequisite: ACG 201; FIN 335; MGT 350 or equivalent. Strategic and tactical issues of information systems and technology are addressed as they support and lead the operations of the organization. Models of the organization and its operations are designed. Multifaceted evaluations of organizational information systems are performed.

**MIS 532. Network Services Administration (3)** Prerequisite: CSC 344 or MIS 323 or equivalent. The study of fundamental network services in organizations. Hands on configuration and administration of network-based services. Special emphasis is placed on security and organizational policy with regard to these services.

**MIS 534. Information Security Management (3)** Prerequisite: CSC 344 or MIS 323; ACG 201; MGT 350; or equivalent. An examination of the principles and processes of security management in networked computer-based systems, including hands-on implementation in a laboratory environment. Risk assessment, planning, protection, and incident and disaster response measures, as well as emerging privacy, legal and ethical issues will be covered in detail.

**MIS 555. Database Management Systems (3)** Prerequisite: CSC 455 or MIS 315; MGT 350; MKT 340 or equivalent. Study of the design and administration of database systems in a business environment. Topics include relational modeling, normalization, data integrity, data standards, indexing, performance monitoring and tuning, and general administration of an enterprise level relational database management system.

**MIS 560. Data Mining (3)** Prerequisite: QMM 280, STT 215, or equivalent. This course covers the major techniques of data mining and their application to business. Data mining is an interdisciplinary, computer-based process for finding patterns within data. This course provides an introduction and a hands-on experience with data mining software.

**MIS 564. (CSC 564) Computer and Network Security (3)** Prerequisite: CSC 544. An in-depth coverage of network security technologies, network design implications, and security planning for an organization's computer network. Procedures for the identification, preservation and extraction of electronic evidence. Auditing and investigation of network and host intrusions. Forensic tools and resources for systems administrators and information system security officers.

**MIS 565. Analysis, Modeling and Design (3)** Prerequisite: CSC 450 or MIS 411 and MIS 413; ACG 201; FIN 335; or equivalent. Analysis and modeling of information systems. Topics include project estimation and management, logical design methodologies and techniques, make or buy decisions, risk analysis, implementation issues, and training.

**MIS 567. Software Architecture and Development Practices (3)** Prerequisite: CSC 550, MIS 565, and MIS 555, or permission of instructor. Study of current development practices for creating high quality software. Topics include current software design practices, coding practices, testing practices, version and configuration control practices, and error-tracking practices. The particular techniques will change with the industry view of best practices.

**MIS 575. e-Business Strategies and Implementation (3)** Prerequisite: CSC 221, MIS 316, or equivalent. Global businesses recognize the need for an external as well as internal web presence. Intranets and Extranets are commonplace and are necessary to remain competitive. This course provides the strategic and technical essentials of what IT professionals should know in order to manage, lead and implement internal and external internet initiatives.

**MIS 585. Copyright, Privacy, and Cyber Law (3)** The legal aspects of managing technology, such as intellectual property, e-commerce, contracting, cybertorts, and technology policy are primary issues covered. Intellectual property law is of particular importance to managers of technology, as well as online contracting, privacy, employment law, and the scope of governmental regulation of technology.

**MIS 587. (CSC 587) Systems Simulation (3)** Prerequisite: QMM 280, STT 215, or equivalent. Study of the techniques and applications of computer simulation of systems. Students will learn to plan simulation studies, program them in a simulation language, perform the study, and analyze the results with statistical rigor. Also covered are random number generation, input distribution selection, generating random variables, and variance reduction techniques.

**MIS 590. Research Methods (3)** Prerequisite: QMM 280, STT 215, or equivalent. Review of descriptive and inferential statistics. Advanced inferential techniques including multiple regression, correlation analysis, non-parametric techniques, and sampling techniques.

**MIS 591. (CSC 591) Directed Independent Study (1-6)** Prerequisite: Permission of instructor. Involves investigation under faculty supervision beyond what is offered in existing courses.

**MIS 592. (CSC 592) Topics in Computing (1-6)** Prerequisite: Permission of instructor. Topics in computing of current interest not covered in existing courses.

**MIS 594. (CSC 594) Research Project (1-6)** Prerequisite: Permission of instructor. Focused study of a research topic in the practical application of computer science or information systems under the guidance of a faculty member. Topics are selected by the student with faculty and graduate coordinator approval. Written analysis and oral presentation of the project is required.

**MIS 595. (CSC 595) Research Seminar (1-6)** Prerequisite: Permission of instructor. Research and discussion of selected topics in computer science or information systems. Oral presentation required.

**MIS 598. (CSC 598) Internship (1-6)** Prerequisite: Overall GPA of at least 3.0. Academic training and practical experience through work in a private company or public agency. Faculty supervision and evaluation of all study and on-site activity. Students must secure permission of the graduate coordinator.

**MIS 599. (CSC 599) Thesis (1-6)**

**OPS 572. Project Management (2-3)** This course introduces the problems of managing a project with the purpose of achieving a specific objective. There will be an in-depth coverage of the operational and conceptual issues faced by modern project managers in all organizational settings. Students will learn techniques, terms and guidelines that are used to manage costs, schedules, risk, group dynamics and technical aspects throughout the life cycle of the project. Special emphasis will be on the use of current P.M. software.