

2003

Graduate School of Computer and Information Sciences

Nova Southeastern University

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Nova Southeastern University
Graduate School of Computer and Information Sciences

Graduate Catalog

2003–2004

Graduate School of Computer and Information Sciences
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October 30, 2003

The Curriculum for the Ph.D./Ed.D. in Computing Technology in Education

The program requires 64 credit hours, of which 40 are for courses and 24 are for the dissertation. Most students take two core/elective courses and one project course per term during the first two years and register for the dissertation in the third year. Students are required to take concurrently the core course and project course in Research Methodology (DCTE 700/800). Core courses, elective courses, project courses, and dissertation registrations are listed below:

Core Courses (three credits each) (All students must take these.)

- DCTE 700 Research Methodology
- DCTE 720 Human-Computer Interaction
- DCTE 730 Online Learning Environments
- DCTE 740 Telecommunications and Computer Networks
- DCTE 750 Educational Database Systems
- DCTE 760 Instruction Delivery Systems
- DCTE 770 Courseware Design and Development

Elective Courses (three credits each) (Select one of these.)

- DCTE 747 Learning Theory and Computer Applications
- DCTE 790 Special Topics in Computing Technology in Education

Project Courses (four credits each) (Select four of these. Must be taken concurrent with, or following completion of, the corresponding core or elective course.)

- DCTE 800 Project in Research Methodology (required concurrent with DCTE 700)
- DCTE 820 Project in Human-Computer Interaction
- DCTE 830 Project in Online Learning Environments
- DCTE 840 Project in Telecommunications and Computer Networks
- DCTE 847 Project in Learning Theory and Computer Applications
- DCTE 850 Project in Educational Database Systems
- DCTE 860 Project in Instruction Delivery Systems
- DCTE 870 Project in Courseware Design and Development
- DCTE 890 Project in Special Topics in Computing Technology in Education

Dissertation Registrations

- DCTE 910 Dissertation I (12 credits)
- DCTE 915 Dissertation II (12 credits)
- DCTE 920 Continuing Dissertation (6 credits)

Course Descriptions for the Ph.D./Ed.D. in Computing Technology in Education

DCTE 700 Research Methodology (3 credits)

An in-depth treatment of the research process from an experimental, developmental, and evaluative perspective is provided. Techniques for planning and designing these types of projects as well as the methodologies for data collection, evaluation, and analysis are examined. Special emphasis is placed on the appropriate choice of methodologies for a variety of problem situations in both business and educational settings. Major emphasis is placed on the development of the proposal stage of research. Corequisite: DCTE 800.

DCTE 720 Human-Computer Interaction (3 credits)

Techniques facilitating effective human-computer interaction are presented. Basic elements, procedures, tools, and environments contributing to the development of a successful user interface are explored. Design principles, guidelines, and methodologies for building, installing, managing, and maintaining interactive systems that optimize user productivity are reviewed. Topics include the multidisciplinary dynamics of human-computer interaction, current and projected developments in HCI research, usability engineering, computer-supported cooperative work, and strategies for implementing and evaluating human-computer dialogues.

DCTE 730 Online Learning Environments (3 credits)

This course covers theory and practice involving online learning systems and online communication processes. It explores models of online learning environments (OLEs) as viable alternatives or supplements to traditional campus or building-based learning. Students will investigate the theoretical, conceptual, instructional, and technical framework of implementing and using OLEs in pursuit of lifelong learning. Relevant issues include the technology infrastructure, program development and administration, and most significantly, the Internet as cyberschool. (The Institute course usually has a collaborative online component.)

DCTE 740 Telecommunications and Computer Networks (3 credits)

Recent advances and new applications in the expanding field of telecommunications and computer networks are examined. The technical fundamentals, architecture, and design of computer networks are described. Strategies, tools, and techniques for network planning, implementation, management, maintenance, and security are delineated. Topics include ISDN, ATM, the OSI model, transmission media, network operating systems, topologies, configurations, protocols, and performance characteristics. Trends in standardization, internetworking, and the development of local area networks (LANs), metropolitan area networks (MANs), wide area networks (WANs), intranets, and extranets are examined.

DCTE 747 Learning Theory and Computer Applications (3 credits)

Computing technology is assuming an increasingly dominant role in instructional delivery. In this course, students explore learning theories and how learning is achieved when instruction is presented from a computer-based paradigm. The course examines the value of the computer as a learning device to model learning theories associated with behaviorism, cognitivism, and human information processing. An emphasis will be placed on current issues, future directions, and research topics.

DCTE 750 Educational Database Systems (3 credits)

Techniques for determining database requirements and managing organizational data resources are examined. Strategies for designing database management systems applications that satisfy specific requirements are presented. Components and architecture of the relational data model are analyzed. Methods for creating and implementing object-oriented information systems are explored. Topics include object-oriented languages, the user interface, databases and expert systems, distributed computing, and the advantages and drawbacks of commercially available DBMS tools and products.

DCTE 760 Instruction Delivery Systems (3 credits)

This course provides opportunity for independent, creative, innovative exploration and development in teaching and learning in the Age of Communications. Course content combines experiential learning based in the asynchronous student forum with related scholarly pursuit. Synchronous and asynchronous delivery systems in buildings and in cyberspace will enable the best possible matches between societal needs and instruction delivery. The purpose of this course is to reengineer education to meet the needs of society, to use any and all technology to devise the best possible learning experiences for learners of all ages.

DCTE 770 Courseware Design and Development (3 credits)

This course deals with the analysis, design, development, implementation, and evaluation (ADDIE) of technology-based, content- and multimedia-intensive, interactive courseware. The product may be constructed with an authoring system or a state-of-the-art, visual programming language. It may be accessed from a floppy disk, a zip disk or a CD-ROM and may be read through a browser or a run-time program.

DCTE 790 Special Topics in Computing Technology in Education (3 credits)

This course introduces state-of-the-art topics in emerging fields relevant to the program. Topics may cover theory, practice, development, experimentation, assessment, or application. Several special topics courses may be offered concurrently.

DCTE 800 Project in Research Methodology (4 credits)

This course focuses on the collection and analysis of data collected from experimental, developmental, and evaluative studies. Emphasis will be placed on the application of tools and techniques appropriate to the scenario and data type collected. The logical development of decisions based on the data analysis in terms of predefined hypotheses and/or project goals and objectives will be discussed. Major emphasis is placed on the development of the report stage of research. Corequisite: DCTE 700.

DCTE 820 Project in Human-Computer Interaction (4 credits)

Students produce a research paper or project on a current topic in HCI. Some topics of current interest include interface quality and evaluation, computer system and computer interface architecture, user and task analysis, advancements in usability engineering, Internet-based user interface design issues, legal and ethical aspects of computing, speech interfaces, agent technology, handheld and wearable technology, and computer-supported cooperative work.

DCTE 830 Project in Online Learning Environments (4 credits)

Students will produce original work that is grounded in theory and practice on a relevant issue in OLE research. Students will be encouraged to submit their work for potential presentation at conferences or for possible publication related to educational technology and online learning research.

DCTE 840 Project in Telecommunications and Computer Networks (4 credits)

Students pursue a research study, project, or implementation in telecommunications and computer networks.

DCTE 847 Project in Learning Theory and Computer Applications (4 credits)

Students pursue a research study, project, or implementation in learning theory and computer applications.

DCTE 850 Project in Educational Database Systems (4 credits)

Students pursue a research study, project, or implementation in educational database management systems.

DCTE 860 Project in Instruction Delivery Systems (4 credits)

The goal of the project is for each student to prepare a publishable, scholarly article and a public presentation within the area of instruction delivery systems. In addition, participants will serve as editorial board members to sharpen their critical evaluation skills.

DCTE 870 Project in Courseware Design and Development (4 credits)

It is recommended that students enroll in 770 and 870 concurrently. The combined courses require the production of an entire courseware package, alpha testing for functionality and beta testing for effectiveness with the target population. The evaluation processes coupled with reflections on the instructional design process and plans for future modifications make for a highly satisfactory professional learning experience.

DCTE 890 Project in Special Topics in Computing Technology in Education (4 credits)

The goal of the project is to extend the learning experience of the accompanying 790 course. Procedures for implementation are subject to the discretion of the course professor.

DCTE 910 Dissertation I (12 credits)

The student develops a framework within which doctoral research will be conducted and offers evidence of qualifications to pursue the research. Prerequisite: Satisfactory completion of all course work.

DCTE 915 Dissertation II (12 credits)

Concepts and theories underlying the student's doctoral research are articulated; the problem is clearly stated; specific, measurable goals are specified; a thorough literature review is presented; the methods of conducting the research are delineated and a strategy to achieve the goal is given. Prerequisite: Dissertation I.

DCTE 920 Continuing Dissertation (6 credits)

Students who have not completed the dissertation by the end of Dissertation II must register for Continuing Dissertation each term in order to receive faculty and administrative advice and support related to the dissertation. Prerequisite: Dissertation II.

DCTE 1200 Directed Independent Study (3 credits or 4 credits)

Involves directed readings, research, and creative activities under the supervision of a faculty member. A contract for independent study must be prepared by the student, include an assignment timeline, and be approved by the mentoring faculty member and the program director. (See the section Independent-Study Basis, Directed Independent Study, or Taking a Course in Another Program)

Ph.D. Program in Information Science

This program offers a course of study leading to the degree of doctor of philosophy (Ph.D.) in information science. This is an interdisciplinary program drawing on the fields of information systems and computing technology in education. It is offered in both cluster and institute formats, which combine traditional and online instruction to provide professionals the opportunity to pursue graduate study while continuing to work in their current positions. The program focuses on information organization and retrieval, which have evolved into issues of enormous importance in light of the continued rapid developments in computing technology. The program is especially well suited to professionals working in a library or information center environment in education, business, government, or industry. It provides research- and technology-oriented professionals the knowledge and ability to develop creative solutions to substantive real-world problems in information science. Each student must complete eight courses, four projects, and a dissertation.

Program-Specific Admission Requirements (See Application for Admission for general requirements.)

This program is designed for the student with a master's degree in information systems, information science, library science, computer education, or a closely related area. The candidate must have a significant amount of experience using computer applications and the Internet. Alternatively, SCIS master's students may apply for early admission into the Ph.D. program. (For details, see sections on early admission under Master's Degree Programs.)

The Curriculum for the Ph.D. in Information Science

The program requires 64 credit hours, of which 40 are for courses and 24 are for the dissertation. Most students take two core/elective courses and one project course per term during the first two years and register for the dissertation in the third year. Core/elective courses, project courses, and dissertation registrations are listed below:

Core Courses (three credits each) (All students must take these.)

DCTE 720 Human-Computer Interaction
DISC 725 Online Information Systems
DISC 735 Knowledge Management
DCTE 740 Telecommunications and Computer Networks
DISS 770 Information Policy
DISS 780 Multimedia Systems

Elective Courses (three credits each) (Select two of these.)

DCTE 700 Research Methodology (DCTE 800 must be taken concurrently)
or DISS 700 Research Methodology
DCTE 730 Online Learning Environments
DCTE 750 Educational Database Systems
DISS 755 Information Security
DISC 790 Special Topics in Information Science (offered on various subjects)

Project Courses (four credits each) (Select four of these. Must be taken concurrent with, or following completion of, the corresponding core or elective course.)

DCTE 800 Project in Research Methodology (must be taken concurrent with DCTE 700)
or DISS 800 Project in Research Methodology (must be taken concurrent with DISS 700)
DCTE 820 Project in Human-Computer Interaction
DISC 825 Project in Online Information Systems
DCTE 830 Project in Online Learning Environments
DISC 835 Project in Knowledge Management

- DCTE 840 Project in Telecommunications and Computer Networks
- DCTE 850 Project in Educational Database Systems
- DISS 855 Project in Information Security
- DISS 870 Project in Information Policy
- DISS 880 Project in Multimedia Systems
- DISC 890 Project in Special Topics in Information Science

Dissertation Registrations

- DISC 910 Dissertation I (12 credits)
- DISC 915 Dissertation II (12 credits)
- DISC 920 Continuing Dissertation (6 credits)

Course Descriptions for the Ph.D. in Information Science

DCTE 700 Research Methodology (3 credits)

An in-depth treatment of the research process from an experimental, developmental, and evaluative perspective is provided. Techniques for planning and designing these types of projects, as well as the methodologies for data collection, evaluation, and analysis are examined. Special emphasis is placed on the appropriate choice of methodologies for a variety of problem situations in both business and educational settings. Major emphasis is placed on the development of the proposal stage of research.

DCTE 720 Human-Computer Interaction (3 credits)

Techniques facilitating effective human-computer interaction are presented. Basic elements, procedures, tools, and environments contributing to the development of a successful user interface are explored. Design principles, guidelines, and methodologies for building, installing, managing, and maintaining interactive systems that optimize user productivity are reviewed. Topics include the multidisciplinary dynamics of human-computer interaction, current and projected developments in HCI research, usability engineering, computer-supported cooperative work, and strategies for implementing and evaluating human-computer dialogues.

DISC 725 Online Information Systems (3 credits)

The evolution, design, and structure of online information systems. Principles, concepts, and techniques for information retrieval. Topics include the methodology of the search process, bibliometrics, the World Wide Web, user interface design and considerations, hypermedia and related technologies, as well as information standards. Trends in system enhancements, use of online services for information retrieval, electronic document delivery, electronic publishing, and end-user training and support. Problems and issues associated with electronic information access and delivery.

DCTE 730 Online Learning Environments (3 credits)

This course explores the emergence of online learning environments (OLEs) as viable alternatives or supplements to traditional classroom instruction. Students will investigate the theoretical, conceptual, instructional, and technical framework of implementing and using OLEs to support the learning paradigm. The basic technology and pedagogical implications of OLEs will be explored, including issues such as learning communities and learning technologies, the Internet and the web, online electronic performance systems, asynchronous/synchronous communication tools, methods of instruction and online tools to support learning and instruction, design of OLEs, faculty and learner considerations, and evaluation of OLEs.

DISC 735 Knowledge Management (3 credits)

Principles of knowledge management and their use in locating, evaluating, disseminating, and using information and knowledge. Application of these principles and techniques through the use of rapidly evolving information/communication technologies is delineated in the context of a flexible and responsive organizational structure. This nexus, which can promote innovation, improve efficiency and effectiveness, and provide a sustainable competitive advantage in today's global environment, is outlined.

DCTE 740 Telecommunications and Computer Networks (3 credits)

Recent advances and new applications in the expanding field of telecommunications and computer networks are examined. The technical fundamentals, architecture, and design of computer networks are described. Strategies, tools, and techniques for network planning, implementation, management, maintenance, and security are

Faculty and Staff of the Graduate School of Computer and Information Sciences

The Faculty

Gertrude W. Abramson, Ed.D., Columbia University. Professor. Online teaching and learning, distance learning programs and communications, instructional systems design, development, delivery and evaluation.

James Cannady, Ph.D., Nova Southeastern University. Assistant Professor. Network intrusion prevention, detection, and response; complexity theory and complex adaptive systems; machine learning; information assurance.

Maxine S. Cohen, Ph.D., State University of New York at Binghamton. Professor. Human-computer interaction, multimedia, usability engineering, human factors, database systems, distance education.

Laurie P. Dringus, Ph.D., Nova Southeastern University. Professor. Human-computer interaction, group support systems, usability engineering, online learning environments, learning theory, distance learning.

Timothy J. Ellis, Ph.D., Nova Southeastern University. Associate Professor. Multimedia design and application, application of database technology to education, online learning environments, adult education.

George K. Fornshell, Ph.D., Nova Southeastern University. Associate Professor. Instructional design, instructional technology, instructional video, streaming media, distance learning, multimedia, authoring tools, human factors.

William L. Hafner, Ph.D., Nova Southeastern University. Assistant Professor. Information storage and retrieval, privacy and information security, data warehousing, knowledge management.

William M. Hartman, Ph.D., Nova Southeastern University. Lecturer. Software engineering, data communications, computer networks, decision support systems, mathematics in computing.

Michael J. Laszlo, Ph.D., Princeton University. Professor. Computer graphics, data structures and algorithms, software engineering, programming.

Yair Levy, Ph.D., Florida International University. Assistant Professor. Online learning systems effectiveness, value of information systems, eCommerce, telecommunications and networking.

Edward Lieblein, Ph.D., University of Pennsylvania. Professor and Dean. Software engineering, object-oriented design, programming languages, automata theory.

Marlyn Kemper Littman, Ph.D., Nova Southeastern University. Professor. Computer networks, ATM, wirefree and wire-based communications, network security, distance learning.

Frank Mitropoulos, Ph.D., Nova Southeastern University. Instructor. Programming languages, data structures, software engineering, object-oriented design, C, C++, Java.

Sumitra Mukherjee, Ph.D., Carnegie Mellon University. Professor. Artificial intelligence, decision support systems, knowledge-based expert systems, database security, database management, economics of information systems.

Easwar Nyshadham, Ph.D., University of Mississippi. Assistant Professor. Electronic commerce, decision support systems, security, privacy and trust in online environments, economics of information systems.

Amon Seagull, Ph.D., University of Rochester. Assistant Professor. Natural language processing, computational linguistics, statistical modeling, programming languages, artificial intelligence, institutional research.

John Scigliano, Ed.D., University of Florida. Professor. Management information systems, client-server computing, project management, instruction delivery systems.

Greg Simco, Ph.D., Nova Southeastern University. Associate Professor. Operating systems, data communications, computer networks, client-server computing, distributed systems, systems performance evaluation.

Junping Sun, Ph.D., Wayne State University. Professor. Database management systems, data warehousing, knowledge discovery and data mining.

Steven R. Terrell, Ed.D., Florida International University. Professor. Research methodology and statistics, learning theory, distance education.

Ling Wang, Ph.D., Purdue University. Assistant Professor. Research methodology and statistics, instructional design, motivation in education, learning theory.

Visiting and Adjunct Faculty

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Ray Albert, Ph.D.

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Terry McQueen, D.B.A.

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Helen St. Aubin, Ph.D.

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Reference List

American Psychological Association. (2001). *Publication Manual of the American Psychological Association* (5th ed.). Washington, DC: Author.

Brown, Leslie (Ed.). (1993). *New Shorter Oxford English Dictionary* (Vol. 2). Oxford: Oxford University Press.

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Dupré, Lyn (1998). *Bugs in Writing: A Guide to Debugging Your Prose*. Reading, MA: Addison-Wesley.

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Zinsser, William (2001). *On Writing Well: The Classic Guide to Writing Nonfiction*. New York, NY: Harper Collins.

Minimum Computer Requirements

What are my computer requirements?

You must have an active account with an Internet service provider (ISP). Students may use either an IBM-compatible PC or Apple/Macintosh computer for their online studies. Students will be provided SCIS accounts that will allow access to certain databases, Forums, ESET, and other programs. The following are minimum requirements. Individual professors may have additional software and hardware requirements, depending on the course. Such additional requirements will be posted well before the start of the term.

IBM-compatible PC

- Pentium II/233 MHz processor or higher, Pentium III/4 processor recommended
- 64 Megabytes of RAM (128MB or higher preferred)
- CD-ROM
- 20GB hard drive (30GB or higher preferred)
- SVGA (1024 x 768) or higher display
- Full Duplex Sound card with speakers/headphones and microphone
- Windows Operating System
- 56 kb Modem (or faster)
- Internet connection through an account on an ISP, or a network connection to the Internet

Macintosh

- PowerPC 120Mhz processor or higher, G4 processor recommended
- 64 Megabytes of RAM (128MB or higher preferred)
- CD-ROM
- 20GB hard drive (30GB or higher preferred)
- 1024 x 768 or higher display resolution, thousands of colors
- Full Duplex Sound with a microphone
- System 8.0 or higher operating system
- 56 kb Modem (or faster)
- Internet connection through an account on an ISP, or a network connection to the Internet

Software

- Netscape 4.75 or higher, or Microsoft Internet Explorer 5.0 or higher
- Adobe Acrobat Reader 5.0 or higher
- Microsoft Office 2000 (or higher)
- Proprietary browser versions (those not downloaded directly from Netscape or Microsoft) may not work reliably with SCIS online systems. If you use other office type programs, please note that some professors may require you to convert your files to a MS-Office compatible format for online submission.
- Your connection to the internet may initiate behind a firewall, however the firewall settings may have to be adjusted in order to allow for proper functioning of our web based tools.
- Any other operating system may be used (e.g., Linux) but must support the software specified above

Academic Calendar, Master's Programs
(Master's programs have rolling admissions)

Fall 2003 (Sept 22 – Dec 12, 2003) Term Code: 200420

Before Sept 12, 03 Registration period (no late fees)
Sept 13–22, 03 Late registration period (late fees)
Sept 22, 03 First day of term
Sept 27, 03 Drop/add deadline
Nov 27–28, 03 Holiday
Nov 22, 03 Last day to withdraw from a course
with a final grade of W
Nov 29, 03 Last day to request an Incomplete
Dec 12, 03 Last day of term

Winter 2004 (Jan 5 – Mar 26, 2004) Term Code: 200430

Before Dec 26, 03 Registration period (no late fees)
Dec 27 03–Jan 5, 04 Late registration period (late fees)
Jan 5, 04 First day of term
Jan 10, 04 Drop/add deadline
Jan 19, 04 Holiday
Mar 6, 04 Last day to withdraw from a course
with a final grade of W
Mar 13, 04 Last day to request an Incomplete
Mar 26, 04 Last day of term

Spring 2004 (Mar 29 – Jun 18, 2004) Term Code: 200440

Before Mar 19, 04 Registration period (no late fees)
Mar 20–29, 04 Late registration period (late fees)
Mar 29, 04 First day of term
Apr 9, 04 Holiday
Apr 3, 04 Drop/add deadline
May 31, 04 Holiday
May 29, 04 Last day to withdraw from a course
with a final grade of W
Jun 5, 04 Last day to request an Incomplete
Jun 18, 04 Last day of term

Summer 2004 (Jun 21 – Sept 10, 2004) Term Code: 200505

Before Jun 11, 04 Registration period (no late fees)
Jun 12–21, 04 Late registration period (late fees)
Jun 21, 04 First day of term
Jun 26, 04 Drop/add deadline
Aug 21, 04 Last day to withdraw from a course
with a final grade of W
Aug 28, 04 Last day to request an Incomplete
Sept 6, 04 Holiday
Sept 10, 04 Last day of term

Fall 2004 (Sept 20 – Dec 10, 2004) Term Code: 200520

Before Sept 10, 04 Registration period (no late fees)
Sept 11–20, 04 Late registration period (late fees)
Sept 20, 04 First day of term
Sept 16, 04 Holiday
Sept 25, 04 Drop/add deadline
Nov 20, 04 Last day to withdraw from a course
with a final grade of W
Nov 25–26, 04 Holiday
Nov 27, 04 Last day to request an Incomplete
Dec 10, 04 Last day of term

Winter 2005 (Jan 3 – Mar 25, 2005) Term Code: 200530

Before Dec 24, 04 Registration period (no late fees)
Dec 25 04–Jan 3, 05 Late registration period (late fees)
Jan 3, 05 First day of term
Jan 8, 05 Drop/add deadline
Jan 17, 05 Holiday
Mar 5, 05 Last day to withdraw from a course
with a final grade of W
Mar 12, 05 Last day to request an Incomplete
Mar 25, 05 Last day of term

Spring 2005 (Mar 28 – Jun 17, 2005) Term Code: 200540

Before Mar 18, 05 Registration period (no late fees)
Mar 19–28, 05 Late registration period (late fees)
Mar 28, 05 First day of term
Apr 2, 05 Drop/add deadline
May 28, 05 Last day to withdraw from a course
with a final grade of W
May 30, 05 Holiday
Jun 4, 05 Last day to request an Incomplete
Jun 17, 05 Last day of term

Academic Calendar, Doctoral Programs
(Doctoral programs have rolling admissions)

Fall 2003 (Sept 5, 2003 – Feb 3, 2004) Term Code: 200420

Jul 28–Aug 21, 03 Registration period (no late fees)
Aug 22–Sept 5, 03 Late registration period (late fees)
Sept 4, 03 New student orientation
Sept 5, 03 First day of term
Sept 5–7, 03 First meeting dates
Sept 6, 03 Drop/add deadline
Dec 5–7, 03 Second meeting dates
Jan 13, 04 Last day to withdraw from a course
with a final grade of W
Jan 21, 04 Last day to request an Incomplete
Feb 3, 04 Last day of term

Winter 2004 (Jan 4 – Jun 3, 2004) Term Code: 200430

Nov 24–Dec 18, 03 Registration period (no late fees)
Dec 19 03–Jan 4, 04 Late registration period (late fees)
Jan 3, 04 New student orientation
Jan 4, 04 First day of the term
Jan 4–9, 04 Meeting dates
Jan 5, 04 Drop/add deadline
May 13, 04 Last day to withdraw from a course
with a final grade of W
May 21, 04 Last day to request an Incomplete
Jun 3, 04 Last day of term

Spring 2004 (Mar 5 – Aug 3, 2004) Term Code: 200440

Jan 26–Feb 19, 04 Registration period (no late fees)
Feb 20–Mar 5, 04 Late registration period (late fees)
Mar 4, 04 New student orientation
Mar 5, 04 First day of the term
Mar 5–7, 04 First meeting dates
Mar 6, 04 Drop/add deadline
Jun 4–6, 04 Second meeting dates
Jul 13, 04 Last day to withdraw from a course
with a final grade of W
Jul 21, 04 Last day to request an Incomplete
Aug 3, 04 Last day of term

Summer 2004 (Jul 11 – Dec 10, 2004) Term Code: 200515

Before Jun 25, 04 Registration period (no late fees)
Jun 25–Jul 11, 04 Late registration period (late fees)
Jul 10, 04 New student orientation
Jul 11, 04 First day of term
Jul 11–16, 04 Meeting dates
Jul 12, 04 Drop/add deadline
Nov 19, 04 Last day to withdraw from a course
with a final grade of W
Nov 27, 04 Last day to request an Incomplete
Dec 10, 04 Last day of term

Fall 2004 (Sept 10 2004 – Feb 9, 2005) Term Code: 200520

Before Aug 27, 04 Registration period (no late fees)
Aug 27–Sept 10, 04 Late registration period (late fees)
Sept 9, 04 New student orientation
Sept 10, 04 First day of term
Sept 10–12, 04 First meeting dates
Sept 11, 04 Drop/add deadline
Dec 3–5, 04 Second meeting dates
Jan 19, 05 Last day to withdraw from a course
with a final grade of W
Jan 27, 04 Last day to request an Incomplete
Feb 9, 05 Last day of term

Winter 2005 (Jan 9 – Jun 8, 2005) Term Code: 200530

Before Dec 24, 04 Registration period (no late fees)
Dec 24 04–Jan 9, 05 Late registration period (late fees)
Jan 8, 05 New student orientation
Jan 9, 05 First day of term
Jan 9–14, 05 Meeting dates
Jan 10, 05 Drop/add deadline
May 18, 05 Last day to withdraw from a course
with a final grade of W
May 26, 04 Last day to request an Incomplete
Jun 8, 05 Last day of term

Spring 2005 (Mar 4 – Aug 3, 2005) Term Code: 200540

Before Feb 18, 05 Registration period (no late fees)
Feb 18–Mar 4, 05 Late registration period (late fees)
Mar 3, 05 New student orientation
Mar 4, 05 First day of term
Mar 4–6, 05 First meeting dates
Mar 5, 05 Drop/add deadline
Jun 3–5, 05 Second meeting dates
Jul 13, 05 Last day to withdraw from a course
with a final grade of W
Jul 21, 04 Last day to request an Incomplete
Aug 3, 05 Last day of term

Nova Southeastern University

Graduate School of Computer and Information Sciences

2003–2004 Graduate Catalog

This catalog describes the degrees and programs offered by the Graduate School of Computer and Information Sciences (SCIS). Policies and programs set forth in the catalog are effective through December 31, 2004. Policies, regulations, and requirements, including fees, are necessarily subject to change without notice at any time at the discretion of the Nova Southeastern University administration. The university reserves the right for any reason to cancel or modify any course or program listed herein. In addition, individual course offerings may vary from year to year as circumstances dictate.

The university recognizes that individual programs require different time limits for the completion of academic studies leading to a degree. Therefore, the time frame is a matter within the discretion of each academic program. All program/center catalogs, bulletins, and handbooks carry this information.

This catalog is the governing document for all program-related information of the Graduate School of Computer and Information Sciences. Please become familiar with the policies and procedures contained within it. Failure to read this catalog does not excuse students from the rules and procedures contained in it. Personal factors, illness, and contradictory advice from any source are not acceptable reasons for seeking exemption from the contents of this catalog. Official versions of this catalog will be posted to the school's website. The catalog posted most recently to the website supercedes previous web and printed versions. If there is any conflict between the information contained in the catalog and that contained in other documents, the information in the catalog prevails.

The *NSU Student Handbook* (2003) specifies university-wide policies (they apply to all NSU students) on student rights, responsibilities, and specific university policies and procedures. The handbook, provided to new students on CD-ROM, may be downloaded from http://www.nova.edu/cwis/current_student.html or from the school's website. Failure to read the *NSU Student Handbook* does not excuse students from the rules, policies, and procedures contained therein.

Nova Southeastern University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools (1866 Southern Lane, Decatur, Georgia 30033-4097; Telephone number 404-679-4501) to award bachelor's, master's, educational specialist, and doctoral degrees. Eight of the school's graduate programs have been certified for inclusion in the Southern Regional Education Board's Electronic Campus. The master of science curricula for computer science and computer information systems follow the guidelines of the Association for Computing Machinery (ACM).

Nova Southeastern University admits students of any race, color, sex, age, nondisqualifying disability, religion or creed, or national or ethnic origin to all rights, privileges, programs, and activities generally accorded or made available to students at the school, and does not discriminate in administration of its educational policies, admission policies, scholarship and loan programs, and athletic and other school-administered programs.

Published October 2003

President's Message

The 21st century will be historic for technological advances, and the Graduate School of Computer and Information Sciences (SCIS) at Nova Southeastern University has accepted the challenge to prepare students for this fast-paced, ever-changing field.

From our early beginnings with 17 students, NSU has grown into the largest independent educational institution in Florida with 16 centers, colleges and schools. NSU has more than 74,000 alumni, and more than 21,000 students enrolled in programs at the main campus, throughout Florida, in 22 states, eight foreign countries, and Puerto Rico. In addition, the university has online students in every state and in over 40 foreign countries.

As an integral component of NSU's quality educational program, SCIS pioneered the electronic classroom, offering online courses in 1983. It now offers all four of its master's degree programs entirely online, which allows degree-seeking working professionals convenience and flexibility.

NSU is continuing to launch new degree programs, and to expand our facilities to meet the needs of our growing community. Construction was completed in fall 2001 of the Alvin Sherman Library, Research, and Information Technology Center, a 325,000 square-foot joint-use facility with Broward County that is open to the community as well as to students, faculty, and staff members of NSU. The largest library in Florida, it has the capacity to hold 1.4 million volumes, and houses 1,000 user seats, a 500-seat performing arts auditorium, 20 electronic classrooms, and museum-style art collections and exhibits. Its presence enhances NSU's efforts to join academe, government, citizenry, and business communities through technology.

Construction is nearing completion of the Carl DeSantis building, which will house the H. Wayne Huizenga School of Business and Entrepreneurship and the Graduate School of Computer and Information Sciences. This five-story, 268,000 square-foot facility will house administration and faculty offices, student service areas, and over 40 classrooms. This facility is made possible through gifts from Wayne and Marti Huizenga, Carl DeSantis, the Hudson Family Foundation, August and Melba Urbanek, Leonard and Antje Farber, and from many other donors.

Recently completed, the Jim and Jan Moran Family Center Village, a \$12.5 million project, houses the university's growing programs for infants, toddlers, and preschoolers. On the horizon is the University Center which will enhance sports, recreational, and cultural activities.

We affirm our commitment to adopt the latest technological advances to improve the delivery of our programs and services. SCIS will continue to preserve our tradition of representing the forefront of education in the age of technology.

The future of education is here.

Ray Ferrero, Jr.

President

Nova Southeastern University

Dean's Message

Welcome to the Graduate School of Computer and Information Sciences (SCIS). In this era of rapid technological growth, each new day brings demands for increased proficiencies of those whose professions intimately involve computers and information technology, e.g., creation of computer/software products or information systems, teaching computing, using computing technology in education and training, managing computing resources, or conducting research. The school understands that it has a critical responsibility to offer programs that are timely yet provide an enduring foundation for future professional growth. To provide timely programs, it reviews its curricula at least once a year, and makes revisions quickly. To provide a solid foundation for future growth, the school's courses are an effective blend of theory and practice that enables students to continue to advance their knowledge after they graduate. To hone skills and develop confidence and independence, our programs place greater-than-usual emphasis on projects. In many cases, a subject course is supplemented by a project course of equal or greater academic credit.

The school's strengths include a distinguished faculty, a cutting edge curriculum, and flexible online and campus-based formats for its four master's and five doctoral degree programs. It has approximately 2,000 graduate students. All programs enable working professionals to earn the M.S., Ph.D., or Ed.D. without interrupting their careers. The school also welcomes students who wish to attend full-time, whether on-campus or online. On-campus evening master's degree programs are tailored to meet the needs of those who reside in South Florida. Online master's programs require no campus attendance and are available to part-time or full-time students worldwide. A unique online doctoral program requires only four weekend or two weeklong campus visits each year. The school has online students living in almost every state in the U.S. and in more than 25 foreign countries. A pioneer in online graduate education, the school began offering online programs in 1983 and created the first electronic classroom in 1985. Since that time, it has developed other unique software tools to enhance the online learning environment. Ranked by *Forbes* as one of the nation's top 20 cyber-universities, and listed in the Princeton Review's *The Best Distance Learning Graduate Schools*, the school currently offers more than 300 online classes annually.

In addition to its regional accreditation by the Commission on Colleges of the Southern Association of Colleges and Schools, SCIS is a certified member of the Electronic Campus of the Southern Regional Education Board. All of its online M.S. courses and programs and four of its doctoral programs are offered via this highly successful consortium. The school also participates in several federal and military programs including the DANTES Distance Learning Program, and the U.S. Army's *eArmyU* online initiative. The school has a chapter of Upsilon Pi Epsilon (UPE), the International Honor Society for the Computing and Information Disciplines, and a student chapter of the Institute of Electrical and Electronic Engineers (IEEE), the largest in Florida.

Online students use web pages to access course materials, announcements, the electronic library, and other information, and participate in a range of activities that facilitate frequent interaction with their professors and fellow students. Online activities may include forums using threaded discussion boards, chatrooms, email, and electronic classroom sessions. In addition, the school provides a system that enables the student to submit assignments online in multimedia formats and to receive his or her professor's online reviews of assignments in the same formats.

I invite you to review our catalog, explore our website, and visit our campus to seek ways in which we can help you fulfill your educational goals. Thank you for visiting our dynamic learning community. I wish you success in your graduate studies and your career.

Edward Lieblein, Ph.D.

Dean

Graduate School of Computer and Information Sciences

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Nova Southeastern University (NSU)

NSU is a dynamic, not-for-profit independent institution dedicated to providing high-quality educational programs of distinction from preschool through the professional and doctoral levels, as well as service to the community. It prepares students for lifelong learning and leadership roles in business and the professions. It offers academic programs at times convenient to students, employing innovative delivery systems and rich learning resources on campus and at distant sites. The university fosters inquiry, research, and creative professional activity, by uniting faculty members and students in acquiring and applying knowledge in clinical, community, and professional settings.

Located on a beautiful 300-acre campus in Fort Lauderdale, Florida, NSU has more than 21,000 students and is the largest independent institution of higher education in the Southeast United States. It is the 10th largest private university in the United States. NSU awards bachelor's, master's, educational specialist, doctoral, and first-professional degrees in more than 80 disciplines. It has an undergraduate college and graduate schools of medicine, dentistry, pharmacy, allied health, optometry, law, computer and information sciences, psychology, education, business, oceanography, and humanities and social sciences. The institution's programs for families, offered through the Family Center and University School, include innovative parenting, preschool, primary, and secondary education programs. Its programs are offered in Fort Lauderdale as well as in locations throughout Florida, across the nation, and at sites in Europe, Canada, Israel, and the Caribbean. Despite the geographic diversity of sites where classes are offered, 82 percent of the student body attends classes in Florida.

The university's library system is composed of: The Alvin Sherman Library, Research, and Information Technology Center; The Shepard Broad Law School Law Library and Technology Center; The William Richardson Oceanographic Library, and the Health Profession Division Library. The catalogs of all NSU libraries are accessible to students and faculty members, wherever they may be located, via computers for remote searching (as are catalogs of other university libraries) using the Electronic Library. Online and CD-ROM databases complement the paper-based holdings and provide full-text resources. NSU is a member of several cooperative networks. As a member of FLIN (Florida Library Information Network) and SEFLIN (Southeast Florida Library Information Network), NSU is able to obtain books and periodicals through interlibrary loan quickly and efficiently. NSU students may also use other SEFLIN libraries. The university continues to expand its library to meet the needs of its growing community. The Alvin Sherman Library, Research, and Information Technology Center is a joint use facility with the Broward County Board of County Commissioners. This recently completed five-story, 325,000 square-foot facility, the largest library in Florida, has 1,000 user seats, 20 electronic classrooms (one is for children), and a 500-seat auditorium.

Nova Southeastern University has produced more than 75,000 alumni. Since 1971, it has enjoyed full accreditation by the Commission on Colleges of the Southern Association of Colleges and Schools, the regional accrediting body for this region of the United States.

The success of NSU's programs is reflected in the accomplishments of its graduates, among whom are:

- Thirty-nine college presidents and chancellors

- More than 100 college vice presidents, provosts, deans, and department chairs

- Sixty-five school superintendents in 16 states, and nine of the nation's largest school districts

- Hundreds of college and university faculty members and administrators nationwide

- More than 100 high-ranking United States military officers, including admirals and generals, and presidents, vice presidents, executives, middle managers, and researchers at companies such as American Express, AT&T, BellSouth, Boeing, Cisco, Compaq, Dell, Ford, General Dynamics, Hewlett-Packard, Lockheed Martin, IBM, Microsoft, Motorola, Nokia, Northrop Grumman, Oracle, Pratt & Whitney, Sprint, Sun Microsystems, Texas Instruments, Verizon, and Walt Disney

The Graduate School of Computer and Information Sciences

A major force in educational innovation, the Graduate School of Computer and Information Sciences (SCIS) provides educational programs of distinction to prepare students for leadership roles in its disciplines. It is distinguished by its ability to offer on-campus, online (via the Internet), and combined on-campus/online formats that enable professionals to pursue M.S., Ed.D., and Ph.D. degrees without career interruption. The school also welcomes students who wish to earn the M.S. Ph.D., or Ed.D. full-time, whether on-campus or online.

Degrees Offered

Master of Science (M.S.)

- Computer Information Systems (optional specialization in Information Security)
- Computer Science
- Computing Technology in Education
- Management Information Systems (optional specializations in Electronic Commerce and Information Security)

Doctor of Philosophy (Ph.D.) or Doctor of Education (Ed.D.)

- Computer Information Systems (Ph.D.)
- Computer Science (Ph.D.)
- Computing Technology in Education (Ph.D. or Ed.D.)
- Information Science (Ph.D.)
- Information Systems (Ph.D.)

Master of Science (M.S.)

Full-time on-campus and online students may complete the degree in 12 months and, in some cases, as little as nine months. Part-time on-campus and online students may complete the degree in 12–18 months. On-campus programs are offered in the evening—each class meets one night a week. The degree requires 36 credit hours (12 courses or 10 courses and a thesis). Master's terms are 12 weeks long and there are four terms each year. They start in September, January, March, and June. To earn the M.S. in 12 months, students must enroll in three courses each term. (Students who wish to take four courses per term must obtain permission from the program office.) To earn the degree in 18 months, students must enroll in two courses each term. On-campus students are permitted to take online courses, and online students are permitted to take on-campus courses. All students must have a computer and an Internet service provider. Students can participate in online courses from anywhere in the world where Internet access is available. The school's master's students may apply for early admission into the doctoral program, which provides the opportunity to earn the Ph.D. or Ed.D. in a shorter time.

Doctor of Philosophy (Ph.D.) or Doctor of Education (Ed.D.)

The school offers a unique doctoral program that requires only four weekend or two weeklong visits to the campus each year. The former is called the *cluster format*, and the latter is called the *institute format*. Both formats include a blend of on-campus and online activities. Students choosing the cluster format attend four cluster sessions each year, held quarterly over an extended weekend at the university, during the first two years of their program. Cluster terms are five months long. They start in September and March. Students choosing the institute format attend weeklong sessions twice a year at the university during the first two years of their program. Institute terms are five months long. They start in January and July.

Clusters and institutes bring together students and faculty for participation in courses, dissertation counseling (individual and group), special lectures, and ample opportunity for student-faculty and student-student interaction. Between sessions students work on assignments and projects, and participate in online activities that facilitate frequent interaction with the faculty and with other students. Interactive learning methods, consistent communication between faculty and students and accessible learning resources provide a powerful and supportive learning environment that can be accessed anywhere around the globe. Online activities may include forums using threaded discussion boards, chatrooms, email, and electronic classroom sessions. In addition, the school provides a system that enables students to submit assignments online in multimedia formats. All students must have a computer and an Internet service provider.

Faculty and Research

The school's faculty members are leaders in their fields and are active in teaching and research over a range of disciplines. The school's research, conducted by students and faculty, advances knowledge, improves professional practice, and contributes to understanding in the computer and information sciences. Faculty research interests are listed in this catalog and also in individual faculty web pages.

General Information on Graduate Programs

Application for Admission

Requirements and procedures for admission are specified in the section Master's Degree Programs or the section Doctoral Degree Programs.

Library Resources

NSU's library system provides access to over 10 million volumes, 200 online databases, and 28,000 full-text journals. The system is comprised of: The Alvin Sherman Library, Research, and Information Technology Center; The Shepard Broad Law School Law Library and Technology Center; The William Richardson Oceanographic Library and the Health Profession Division Library. The Alvin Sherman Library, Research, and Information Technology Center, a five-story, 325,000 square-foot facility, the largest library in Florida, has 1000 user seats, 20 electronic classrooms and a 500-seat auditorium. The catalogs of all NSU libraries are accessible to local and distance education students and faculty members, wherever they may be located, via computers for remote searching (as are catalogs of other university libraries) using the Electronic Library.

Online and CD-ROM databases complement the paper-based holdings and provide full-text resources. NSU is a member of several cooperative networks. As a member of FLIN (Florida Library Information Network) and SEFLIN (Southeast Florida Library Information Network), NSU is able to obtain books and periodicals through interlibrary loan quickly and efficiently. NSU students may also use other SEFLIN libraries. The university continues to expand its library system to meet the needs of its growing community.

Online students have access to books, journal articles, microfiche, dissertations, index searches, catalog searches, and reference librarians. Distance students may request library materials for delivery to their homes or offices using fax, mail, or online forms. Distance Library Services (DLS) can be reached by toll-free phone, by email or via the Web: <http://www.nova.edu/library>. All materials mailed by the DLS office are sent by first-class mail. When books are borrowed, the student will have to pay a small charge for third-class postage to return the books. Books are loaned for one month. Periodical copies need not be returned.

Standards of Academic Integrity

For the university-wide policy on academic standards, see the section Code of Student Conduct and Academic Responsibility in the *NSU Student Handbook*. Also see the section Student Misconduct in this catalog. Each student is responsible for maintaining academic integrity and intellectual honesty in his or her academic work. It is the policy of the school that each student must:

Submit his or her own work, not that of another person

Not falsify data or records (including admission materials)

Not engage in cheating (e.g., giving or receiving help during examinations; acquiring and/or transmitting test questions prior to an examination; and using unauthorized materials, such as notes, during an examination)

Not receive or give aid on assigned work that requires independent effort

Properly credit the words or ideas of others according to accepted standards for professional publications (see *Crediting the Words or Ideas of Others*)

Not use term paper writing services or consult such services for the purpose of obtaining assistance in the preparation of materials to be submitted in courses or for theses or dissertations

Not commit plagiarism (*Merriam-Webster's Collegiate Dictionary* (1996) defines plagiarism as "stealing or passing off ideas or words of another as one's own" and "the use of a created production without crediting the source.") (see *Crediting the Words or Ideas of Others* below)

Crediting the Words or Ideas of Others

When using the exact words of another, quotation marks must be used for short quotations (fewer than 40 words), and block quotation style must be used for longer quotations. In either case, a proper citation must also be provided. *Publication Manual of the American Psychological Association, Fifth Edition*, (2001, pp. 117 and 292) contains standards and examples on quotation methods.

When paraphrasing (summarizing, or rewriting) the words or ideas of another, a proper citation must be provided. (*Publication Manual of the American Psychological Association, Fifth Edition* (2001) contains standards and examples on citation methods (pp. 207–214) and reference lists (pp. 215–281)). The *New Shorter Oxford English Dictionary* (1993) defines paraphrase as "An expression in other words, usually fuller and clearer, of the sense of a written or spoken passage or text...Express the meaning (of a word, phrase, passage, or work) in other words, usually with the object of clarification...". Changing word order, deleting words, or substituting synonyms is not acceptable paraphrasing—it is plagiarism, even when properly cited. Rather than make changes of this nature, the source should be quoted as written.

Grading System

Students will be assigned grades for courses and projects according to the following system:

Grade	Grade Points
A	4.0
A–	3.7
B+	3.3
B	3.0
B–	2.7
C+	2.3
C	2.0
C–	1.7
F	0.0

Grade	Meaning of Grade
I	A temporary grade assigned for incomplete work. See the section The Temporary Grade of Incomplete (I).
W	Withdrawn from course. See the section Grade Policy Regarding Withdrawals.
WU	Withdrawn by the university.
PR	Progress. May be assigned to thesis or dissertation registrations. Carries credit hours but no grade points. Indicates progress toward completion of a thesis or dissertation.
NPR	No Progress. May be assigned to thesis or dissertation registrations. Carries credit hours but no grade points. Indicates insufficient progress toward completion of a thesis or dissertation. Repeated NPR grades may result in evaluation for dismissal.
P	Pass. Thesis and dissertation grades of PR and NPR will be changed to P when the thesis or dissertation report receives final approval.
AU	Audit. For students who register for a course on an audit basis.

To determine the grade point average (GPA), divide the sum of all the grade points earned in graduate courses taken toward the graduate degree by the number of course credit hours taken toward that degree. Only those courses and projects taken toward the degree that carry grade points, except courses that have been repeated and transfer credits, are included in the computation of the GPA. The grades of I, W, WU, P, PR, and NPR do not affect the GPA. With the exception of the grade of I, once a final grade in a course has been recorded by the Office of the University Registrar it can be changed only in cases of computational error or other justifiable cause approved by the dean (Refer to Challenge of Course Grade). A student may not do additional work or repeat an examination to raise a final grade.

The Temporary Grade of Incomplete (I)

The temporary grade of Incomplete (I) will be granted only in cases of extreme hardship. Students do not have a right to an incomplete, which may be granted only when there is evidence of just cause. A student desiring an incomplete must submit a written appeal to the course professor at least two weeks prior to the end of the term. In the appeal, the student must: (1) provide a rationale; (2) demonstrate that he/she has been making a sincere effort to complete the assignments during the term; and (3) explain how all the possibilities to complete the assignments on time have been exhausted. Should the course professor agree, an *incomplete contract* will be prepared by the student and signed by both student and professor. The *incomplete contract* must contain a description of the work to be completed and a timetable. The completion period should be the shortest possible. In no case may the completion date extend beyond 30 days from the last day of the term for master's courses or beyond 60 days from the last day of the term for doctoral courses. The *incomplete contract* will accompany the submission of the professor's final grade roster to the program office. The program office will monitor each *incomplete contract*. If a change-of-grade form is not submitted by the scheduled completion date, the grade will be changed automatically from I to F. No student may graduate with an I on his or her record. The grade of I does not apply to master's thesis or doctoral dissertation registrations.

Grade Policy Regarding Withdrawals (See the degree sections Refund Policy Regarding Withdrawals.)

Course withdrawal requests must be submitted to the program office in writing by the student. Requests for withdrawal must be received by the program office at least three weeks prior to the last day of the term (see Academic Calendar on p. ii). Withdrawals sent by email must be sent from the student's assigned NSU email account. Requests for withdrawal received after 11:59 p.m. EST on the withdrawal deadline date will not be accepted. Failure to attend class or participate in course activities will not automatically drop or withdraw a student from the class or the university. Students who have not withdrawn by the withdrawal deadline will receive letter grades that reflect their performance in the course. When a withdrawal request is approved, the transcript will show a grade of W (*Withdrawn*) for the course. Students with a history of withdrawals risk dismissal.

Repeating a Course

A student who has passed a course with a grade of B– or higher is not permitted to repeat it for credit. A student may repeat a course in which a grade of C+ or lower has been earned, but credit toward the degree and the GPA will be granted only once. Permission for repeating a course must be obtained from the program office. The transcript will show both the original and repeat grades; however, only the higher grade will be counted in the computation of the student's GPA. Students repeating a course must pay course tuition and fees.

Readmission Following Dismissal

In most cases, dismissed students may apply for readmission. Students dismissed for poor academic performance or for violation of academic standards, unless dismissed with no right for future readmission, may apply for readmission after six months have elapsed following dismissal. Students dismissed for exceeding the time limitation may apply for readmission at any time.

Applications for readmission must be submitted to the Office of Admissions and must include the following: (1) \$50 readmission application fee; (2) a new application form; (3) a letter of justification; (4) an updated résumé; (5) two evaluation forms from SCIS faculty members; and (6) transcripts not previously submitted. The letter of justification must describe the reasons why academic potential has changed. Students who are readmitted will be required to meet all program requirements and policies in effect at the time of readmission. Readmitted students must still meet their degree program time limitations based on the date of their first registration in the program unless extensions were granted at readmission. Readmitted students who were dismissed for exceeding the time limitation will be given a new time limit.

Registration Status

Students who are not registered are not eligible for academic services from faculty and staff members and are not eligible to receive computing, library, and other university services. Students who have previously registered may register at any time within their program time limits.

Student Records and Transcripts

The university maintains a system of record keeping and provides students with official grade reports and transcripts reflecting their academic progress. This system documents all official information from the time of application for admission to graduation. Official hard copies of records are maintained by the registrar's office. Records are secured via the computerized student information system in addition to back-up hard copy files. Computer files are secure and kept up to date. The registrar's office follows the American Association of Collegiate Registrars and Admissions Officers (AACRAO) guidelines for the retention and disposal of records. After the appropriate time period, hard copy files are retired to storage. Computer files are moved to historical files and permanent records are microfilmed for later reference. To obtain an official transcript, students or graduates may: (1) complete a Transcript Request Form at the registrar's office; (2) mail the request form to the Office of the University Registrar, 3301 College Avenue, Fort Lauderdale, FL 33314-7796; or (3) fax the request form to 954-262-4862. Additional information and downloadable request forms may be obtained at <http://www.nova.edu/cwis/registrar>. Official transcript of a student's academic record cannot be released until after all of his or her accounts, academic or nonacademic, are paid. Upon completion of a degree program at the university, students receive one transcript without charge. Any other transcripts, before or after graduation, must be specifically requested. For these, there is a \$5 fee for each official transcript requested.

Challenge of Course Grade

A student who wishes to challenge a grade assigned for an entire course must communicate with the course professor, in writing, within ten days of receipt of the grade. In this communication, the student must state the reasons for requesting a change in the grade. A decision will be made by the course professor following his or her review of the appeal. The student will not be permitted further appeal. If, however, evidence of discrimination or a violation of the student's rights is presented, then the Student Grievance Procedure shall be followed. A student may neither do additional work nor repeat an examination to raise a final grade.

Student Misconduct

Students are expected to deport themselves as respectable and respectful members of the academic community. The school will not tolerate acts of academic dishonesty, or behavior that is clearly unethical, unprofessional, flagrantly disruptive, or that violates the general understanding of the proper conduct of graduate students. Committing an act of misconduct will subject the student to dismissal from the university.

Procedures for Resolving Allegations of Student Misconduct

Violations of academic standards will be examined by the Academic Review Committee, which will present its findings to the dean for adjudication. Violations of conduct or supplementary standards will be handled by the Office of the Dean of Student Affairs or by the Graduate School of Computer and Information Sciences. Allegations of student misconduct must be made in writing to the program office by a faculty member, staff member, or student. All pertinent factors, witnesses, events, and evidence related to the alleged misconduct should be included. If the allegations constitute probable cause to proceed, the program director or assistant program director will notify the accused in writing that an inquiry will be conducted. Inquiries regarding alleged violations of academic standards will be conducted by the Academic Review Committee which will submit its findings and recommendation to the dean. Inquiries regarding alleged violations of non-academic standards will be reviewed by the administration of the school and adjudicated by the dean, or will be presented to the Office of the Dean of Student Affairs for adjudication. As part of the inquiry, all pertinent documentary evidence and statements from witnesses will be assembled. The accused will be given an opportunity to provide a written response to the allegations. When misconduct is indicated beyond reasonable doubt, an appropriate sanction will be chosen (see the *NSU Student Handbook* (2003, June)). A report of the findings and penalty will be provided to the accused who may acquiesce in the penalty or may contest and ask for a hearing. Failure of the accused to respond within 20 days shall be construed as acquiescence in the report of the inquiry. If a hearing is requested, it will be conducted by the Academic Review Committee in the case of academic violations or by the Office of the Dean of Student Affairs in the case of non-academic violations. If, after the hearing, the accused is found guilty of misconduct, the dean of the school or the dean of student affairs will decide on the final action to be taken.

Student Grievance Procedure

This section describes the procedure for student grievances regarding academic matters other than grades. If the issue concerns the fairness of a grade the procedure described in the section Challenge of Course Grade must be followed. Grievance procedures for nonacademic disputes are contained in the *NSU Student Handbook*. First, the student should attempt to resolve the dispute at the level at which it occurred, e.g., the appropriate faculty member or program director. This attempt must be in writing. The student may wish to use certified mail to verify receipt of correspondence. In the correspondence, the student must present a rationale for his or her position based on factual information. The student will receive a reply from the recipient, in writing, that addresses the complaint. If the reply is not acceptable, the student is encouraged to submit the complaint, in writing, to the next higher level, e.g., the appropriate

program director. If the program director is unable to resolve the dispute, he or she will notify the student and the dean of this in writing. The student may then appeal in writing to the dean of the Graduate School of Computer and Information Sciences who will attempt resolution. If appropriate, the dean may assign the matter to an Academic Review Committee consisting of at least three faculty members of the school, one of whom will be appointed chair. The committee will meet, carefully review the case, hold a hearing if necessary, and make a written recommendation, including rationale, to the dean to either accept or reject the appeal, or may propose an approach to resolve the dispute. The dean will review the findings and recommendations of the Academic Review Committee, and will notify the student in writing of his or her decision. The dean's decision is final and cannot be appealed.

Communication by Email

Students must use their NSU email accounts when sending email to faculty and staff and must clearly identify their names and other appropriate information, e.g., course or program. When communicating with students via email, faculty and staff members will send mail only to NSU email accounts using NSU-recognized usernames. Students who forward their NSU-generated email to other email accounts do so at their own risk. SCIS uses various course management tools that use private internal email systems. Students enrolled in courses using these tools should check both the private internal email system and NSU's regular email system. NSU offers students web-based email access. Students are encouraged to check their NSU email account daily.

Student Services

NSU Cards

The NSU Card is the official Nova Southeastern identification card and each registered student is issued one. Students are required to carry and display the NSU Card for identification purposes when at the university. Cards are required to check out books from the library and for many other purposes (visit <http://www.nova.edu/nsucard/>). A number of businesses in the community will give students discounted rates on a variety of services ranging from movies to dinner if an NSU card is shown. If an NSU card is lost or destroyed, a new one may be requested at the registrar's office. There is a fee to replace a lost card.

Textbooks

Book information can be found on the SCIS website. Click on Master's Programs or Doctoral Programs and then on Book Information. Barnes & Noble College Bookstores, the university's official bookstore, offers comprehensive services to local and online students. While students have the option to purchase textbooks from other online and local sources, there are benefits from purchasing from the university's bookstore (on-campus or online), including better availability. The university's bookstore provides a wide range of shipping options. The school posts book titles on its website at least one month prior to the start of each term. Students should place their orders early enough to ensure delivery prior to the start of the term. The bookstore may be reached at <http://www.nsubooks.bkstore.com> or at 800-509-2665 or 954-262-4750. There may be occasions when books are not available for the start of the term because they are out of stock or temporarily out of print. In such cases, faculty members will ensure that courses progress according to their schedules.

Student Housing on the Main Campus

One-bedroom and two-bedroom furnished and unfurnished apartments are available for graduate and married students without children. Utilities, basic cable TV, and central air conditioning are included in the housing rates. For further information contact the university's Office of Residential Life and Housing at 954-262-7052 or 800-541-6682, ext. 7052.

Travel Services

Nova Southeastern University has a full-service travel agency that can make reservations, issue airline tickets, and reserve rental cars. In addition, travel agents can also help make arrangements for trips and vacations. NSU's travel agency accepts money orders and major credit cards. The travel agency can be reached at <http://www.nova.edu/cwis/bsv/travel> or via email: <mailto:travel@nova.edu>.

Graduation

Graduation Requirements

Students must complete the minimum number of credit hours designated for the chosen program, and must meet the following requirements:

Admission as a degree-seeking candidate in one of the programs

Satisfy program requirements including completion of courses, master's thesis where appropriate and, for the doctorate, an approved dissertation as specified in program documentation

Doctoral students: Attendance at all required cluster or institute meetings

Attainment of a cumulative grade point average of at least 3.0

Completion of the form *Application for Degree* and payment of graduation fee. The *Application for Degree* form may be downloaded from the school's website or obtained from the program office or the University Registrar. Master's students should complete the form at the time of registration for their final term. Doctoral students should complete the form upon written notification of acceptance of their dissertation report.

Payment of all tuition and fees and fulfillment of all obligations to the library, the student's program, and the office of student financial services

Commencement

A commencement ceremony is held in June or July for Nova Southeastern University graduate students. All graduating students are encouraged to participate in this ceremony. In order for a student to participate, the program director must expect the completion of all the student's graduation requirements within six weeks following the date of the commencement ceremony.

Students expecting to graduate must complete an application for graduation and submit it to the program office at least six weeks prior to the date of the commencement ceremony. The program office will advise the university registrar of eligible students, who will distribute commencement procedures to these students.

Alumni Association

Nova Southeastern University has an active alumni association. It is organized on three levels—local, state, and national—to provide special programs and other services that promote the professional and intellectual growth of graduates and maintain communications between graduates and the university. For information contact the Office of Alumni Relations <http://www.nova.edu/alumni>.

will be evaluated as to the suitability of their transfer into the desired master's degree program. Courses applied to a graduate degree must fall within the time frame specified for the master's degree. An international student on an I-20 cannot be enrolled as a non-degree student. Non-degree students are not eligible for financial aid.

Provisional Admission

Students are provisionally admitted to a degree-seeking program based on a review of unofficial transcripts or other specific program admission requirements. However, this admission includes a condition that final and official documents and requirements must be received within 90 calendar days from the start of the term. If these final and official documents and/or requirements are not received by that time, the student will not be allowed to continue class attendance. Financial aid will not be disbursed to a provisional/conditional student until he or she has been fully admitted as a regular student (all admission requirements have been approved by the school's admissions office).

Transfer Credit Policy

Up to six graduate credits may be transferred from a regionally accredited institution. Courses proposed for transfer must have received grades of at least B. Students must request approval of transfer credits in writing at the time of application (see instruction on the application form). Copies of catalog course descriptions or course syllabi are required to process requests for transfer credits.

Early Admission into the Doctoral Program (See options in the individual M.S. program sections.)

This option provides the school's M.S. students the opportunity to earn the doctoral degree in a shorter time. Minimum requirements for early admission are the completion of 24 credits in the M.S. program with a GPA of 3.5 or higher and the completion of specific master's courses (see master's program sections for details). If admitted into the doctoral program, students will take the remaining 12 credits for the M.S. degree in the doctoral program. Master's students may apply for early admission no sooner than during the term in which they will be completing 24 credits. Students must submit applications for early admission to the SCIS Office of Admissions. Doctoral admission forms may be downloaded from the SCIS website. An application fee is required. The SCIS Office of Admissions will supply the Admissions Committee with the student's current transcripts. Two evaluation forms must be completed by SCIS faculty members (preferably full-time faculty members). Upon successful completion of 12 credits in the doctoral program, the student may apply for the master's degree (contact the program office for a degree application).

Program Formats and Term Dates

Four 12-week terms are offered each year. Terms start in September, January, March, and June. The Academic Calendar for the master's program is contained on page ii of this catalog and is also posted on the school's website at <http://www.scis.nova.edu/Masters/index.html>.

The 36-credit hour program is designed so it may be completed by full-time students in 12 months or by working professionals in 12–18 months while remaining in their current positions. To earn the degree in 12 months, students must enroll in three courses per term. To earn the degree in 18 months, students must enroll in two courses per term. Terms are 12 weeks long and there are four terms each year. Students select one of two formats: on-campus or online (on-campus is not available for the M.S. in computing technology in education). Both formats require the completion of 12 courses or 10 courses and a six-credit thesis. On-campus classes are held on the main campus in Fort Lauderdale. Each class meets once a week from 6:30 p.m. to 9:30 p.m. for 12 weeks. Students electing the online format may participate in online classes from anywhere in the world where Internet access is available.

All SCIS students are provided NSU computer accounts but must obtain their own Internet service providers and use their own computer systems. New students are provided an orientation on computer and software requirements, online access, online tools and methods, and library resources. Students use the web to access course materials, announcements, email, the Electronic Library, and other information and for interaction with faculty and fellow students. Online activities may include visiting web pages, forums using threaded discussion boards, and chatrooms. In addition, the school provides a system that enables the student to submit assignments online in multimedia formats and to receive the professor's online reviews of assignments in the same multimedia formats. Some online courses may include electronic classroom sessions. Students must comply with NSU policies on acceptable use of computing resources and use of material in web pages.

Orientation and Academic Advising

New students are invited to the campus for a Student Success Workshop and are also provided web-based and CD-ROM-based orientations that include computer/software requirements, online access, tools and methods, and library access. The school's website provides an extensive online help system including downloadable software and documents. Academic advising is provided by the program office in concert with the faculty.

Registration

The registration process begins when the program director sends an email to students' NSU email accounts informing them of registration for the upcoming term. Registration materials are also posted on the master's website: <http://www.scis.nova.edu/Masters/Director/index.html>. Students can confirm their registration status by accessing Webstar at <http://webstar.nova.edu>. Students are expected to register during the published registration period. Registration after the close of the published registration period, when permitted, will require the payment of a late fee.

Drop/Add Period

Failure to attend or participate in a class does not automatically drop or withdraw a student from the class. Registered master's students may drop/add a course prior to the first day of the term and up to and including the sixth calendar day of the term (the drop/add period) without penalty. If a course is dropped between the first day of the term and the end of the drop/add period and another course is not added in its place, the withdrawal policy applies.

Refund Policy Regarding Withdrawals (See the section Grade Policy Regarding Withdrawals.)

A student withdrawing from a course may be eligible for a refund (full or partial) of tuition paid (not including fees) depending on the date of withdrawal. Course withdrawal requests must be submitted to the program office in writing (via postal mail or email) by the student. Withdrawals sent by email must be sent from the student's assigned NSU email account and must clearly identify the student. Requests for withdrawal must be received by the program office at least three weeks prior to the last day of the term. Failure to attend class or participate in class activities will not automatically withdraw a student from the class. Students withdrawing between the first and the ninth calendar day of the term will receive a 90 percent refund of tuition paid. Students withdrawing between the 10th and the 21st calendar day of the term will receive a 50 percent refund of tuition paid. Students withdrawing between the 22nd and the 42nd calendar day of the term will receive a 25 percent refund of tuition paid. Students withdrawing after the 42nd calendar day of the term will receive no refund. If a student is using one of the payment plans (see section Tuition Payment Policy) the tuition due or the amount refunded will be adjusted accordingly.

Thesis and Non-Thesis Options

For the thesis option, 30 credit hours of course work and six credit hours for the master's thesis are required. For the non-thesis option, 36 credit hours of course work are required. Students interested in completing the master's thesis should contact the program office to make arrangements.

Form and Style Requirements for Student Work

For an individual course, the course professor will specify form and style requirements in the course syllabus. There are several books that provide general guidelines for form, style, and general writing principles in the preparation of papers, assignments, and reports. *On Writing Well* (Zinsser, 2001) is an excellent guide to clear, logical, and organized writing. *Bugs in Writing* (Dupré, 1998) contains valuable guidance on professional writing and is oriented to the computer and information sciences. The *Publication Manual of the American Psychological Association, Fifth Edition* (2001) addresses editorial style, grammar, and organization, and its use is often required by course professors. Master's students may find the school's *Dissertation Guide* (2003) helpful in the preparation of theses.

Attendance Policy

Master's degree students are expected to be present at each meeting of their classes on campus. Exceptions to this rule may be made in the case of illness and possibly in other instances when approved by the course professor. Students should advise their course professors in advance of any anticipated absences. Additional work may be required by a course professor for any absence. Excessive absences will result in a failing grade. For online master's courses, participation/attendance policies will be covered in the syllabus of each course.

Academic Progress, Grade Requirements, and Academic Standing

Failure to achieve academic progress in two continuous terms of registration will subject the student to review by the Academic Review Committee and possible dismissal. Each student must maintain a cumulative grade point average (GPA) of at least 3.0 to remain in good academic standing. When the cumulative GPA falls below 3.0 the student is automatically placed on academic probation and will not be permitted to graduate. (Academic probation may adversely affect financial aid.) If the cumulative GPA is not raised to 3.0 within two terms the student may be dismissed from the program. Upon achieving a cumulative GPA of 3.0, the student will be removed from academic probation. If the cumulative GPA could not possibly be raised to 3.0 within the required period the student will be dismissed immediately. Students with a history of withdrawals risk dismissal. Students who receive two grades of F will be dismissed immediately.

Time Limitations

Students must complete requirements for the degree within five years from the date of their first registration. Students desiring an extension of time must petition the program office in writing at least one month before the time limit is reached. Extensions may be granted only if the petition presents justifiable cause and an acceptable plan for program completion. In the absence of a petition for extension, the student will be automatically dismissed from the program.

Independent-Study Basis, Directed Independent Study, or Taking a Course in Another Program

Each of these requires the student to submit a request for approval to the Director of Graduate Programs prior to registration. *Independent-study basis* means taking a course that is published in the curriculum of the program under which the student is enrolled but is not currently offered (it would be taken under the supervision of a faculty member). The student would register for the course prefix and number listed in

the curriculum. *Directed independent study* means working on a project or study under the supervision of a faculty member in an area not covered by a course in the published curriculum. The student would register for the course <Prefix> 1200 *Directed Independent Study* (the prefix would identify the student's program). *Taking a course in another program* means taking a course in one of the school's master's programs in which the student is not enrolled. For each of these cases, the program director will review the student's record to determine the appropriateness of the request. If the request appears to be consistent with the student's program and school policies, the director will consult with the appropriate faculty member for possible approval and will notify the student of the decision and any requirements.

Tuition and Fees for Master's Programs (See sections Tuition Payment Policy and Financial Aid.)

Academic, program, and online services are provided only to SCIS students who are currently registered. Students who are not registered are not entitled to receive services. Textbooks are not included in tuition and fees and must be purchased by the student. Students are responsible for their own lodging and travel expenses. Students must be registered to gain access to NSU's computing services.

Tuition	\$425 per credit hour
Application Fee	\$50 nonrefundable
Registration Fee	\$30 nonrefundable
Late Registration Fee.....	\$100 nonrefundable
Readmission Fee	\$50 nonrefundable
Program Change Fee	\$50 nonrefundable
Graduation Fee	\$75
Fee for Installment Payment	\$50

Master of Science (M.S.) in Computer Information Systems

This 36 credit-hour program offers a course of study leading to the master of science (M.S.) in computer information systems. It focuses on the technological foundations of computer information systems including areas such as database systems, human-computer interaction, data and computer communications, information security, computer graphics, software engineering, and object-orientation. It is designed to give students a thorough knowledge of the field and to provide an enduring foundation for future professional growth. The program blends theory and practice into a learning experience that develops skills applicable to complex real-world problems. Its formats offer full-time students the opportunity to earn the degree in 12 months and working professionals the opportunity to earn the degree in 12–18 months. In addition, students have the option to pursue the M.S. in CIS with *specialization in information security*, which requires a total of 42 credit hours. The curriculum is consistent with recommendations for a model curriculum in computer information systems as outlined by the Association of Computing Machinery (ACM).

Program-Specific Admission Requirements (See Application for Admission for general requirements.)

This program is designed for students with undergraduate majors in computer science, information systems, engineering, mathematics, or physics. Applicants must have knowledge of data structures and algorithms, assembly language and computer architecture, structured programming in a modern high-level language, college algebra, and discrete mathematics. Applicants who do not have an adequate background may be required to take one or more of the following 500-level graduate courses during the first two terms of the student's program. These are in addition to the required 36 credit hours at the 600 level. Courses at the 500 level, when required, must be completed prior to taking courses at the 600 level; however some exceptions may be permitted by the program director. MCIS 501 is prerequisite to MCIS 503.

MCIS 500 Assembly Language and Architecture	MCIS 502 Mathematics in Computing
MCIS 501 Java Programming Language	MCIS 503 Data Structures and Algorithms

Early Admission into the Doctoral Program

This option provides the opportunity for master's students in computer information systems to earn the Ph.D. in computer information systems or information systems in a shorter time. In addition to the requirements for early admission specified in the section General Information on Master's Degree Programs, the student must have completed MCIS 611 Survey of Programming Languages, MCIS 615 Operating Systems Concepts, MCIS 620 Information Systems, MCIS 630 Database Systems, and MCIS 645 Software Engineering.

The Curriculum for the M.S. in Computer Information Systems

Core courses and electives are listed below. Students may substitute up to two electives for two core courses. Students who wish to take an additional elective must request approval from the program office prior to registration. If the thesis option is elected, two courses may be omitted. Plans for the thesis option must be made with the program office. Courses constituting the degree program with specialization in information security are listed below following the electives.

Core Courses:

MCIS 611 Survey of Programming Languages
MCIS 615 Operating Systems Concepts
MCIS 620 Information Systems
MCIS 625 Computer Graphics
MCIS 630 Database Systems
MCIS 645 Software Engineering
MCIS 650 Data Communications Networks
MCIS 661 Object-Oriented Applications
MCIS 665 Client-Server Computing
MCIS 670 Artificial Intelligence and Expert Systems
MCIS 671 Decision Support Systems
MCIS 680 Human-Computer Interaction

Electives:

MCIS 621 Information Systems Project Management
MCIS 623 Legal and Ethical Aspects of Computing
MCIS 631 Database Systems Project
MCIS 651 Project in Data Communications Networks
MCIS 652 Information Security
MCIS 654 Electronic Commerce on the Internet
MCIS 681 Multimedia Systems
MCIS 683 Secure Computer Systems
MCIS 684 Applied Cryptography
MCIS 685 Database Security
MCIS 686 Advanced Network Security
MCIS 687 Information Security Project
MCIS 691 Special Topics in Computer Information Systems

The M.S. in CIS with Specialization in Information Security (Required Courses):

MCIS 611 Survey of Programming Languages
MCIS 615 Operating Systems Concepts
MCIS 630 Database Systems
MCIS 645 Software Engineering
MCIS 650 Data Communications Networks
MCIS 665 Client-Server Computing
MCIS 670 Artificial Intelligence and Expert Systems
MCIS 671 Decision Support Systems
MCIS 680 Human-Computer Interaction
MCIS 683 Secure Computer Systems
MCIS 684 Applied Cryptography
MCIS 685 Database Security
MCIS 686 Advanced Network Security
MCIS 687 Information Security Project

Course Descriptions for the M.S. in Computer Information Systems

MCIS 500 Assembly Language and Architecture (3 credits)

A comprehensive examination of the fundamental concepts and architectural structures of contemporary computers. The course focuses on assembly language programming and the influence of low-level computer architecture on modern computer applications.

MCIS 501 Java Programming Language (3 credits)

An in-depth study of the Java programming language. Principles of the object-oriented paradigm. Object-oriented programming theory and practice.

MCIS 502 Mathematics in Computing (3 credits)

Graph theory, lattices and boolean algebras, state models and abstract algebraic structures, logical systems, production systems, computability theory, recursive function theory.

MCIS 503 Data Structures and Algorithms (3 credits)

Sorting and searching, algorithms for tree structures, advanced data structures, graph algorithms, complexity, dynamic programming, optimization problems. Prerequisite: MCIS 501 or equivalent.

MCIS 611 Survey of Programming Languages (3 credits)

Organization and types of programming languages. Analysis of imperative, object-oriented, and declarative language paradigms. Higher-level languages. Comparative analysis of programming languages used in the development of computer information systems.

MCIS 615 Operating Systems Concepts (3 credits)

Objectives of managing computer system resources. Memory management, process management, file system management, scheduling, synchronization, interrupt processing, distributed processing, and parallel systems. An analysis of the role of operating systems in computer information systems development, operation, and evolution.

MCIS 620 Information Systems (3 credits)

Covers major concepts and architecture of computer information systems, including information concepts; information flow; types of information systems; the role of information in planning operations, control, and decision making; integrated information systems across a range of functional elements. Computer information systems in organizations.

MCIS 621 Information Systems Project Management (3 credits)

Life-cycle models/paradigms. Project planning and risk analysis. Project control including work breakdown structures, project scheduling, activities, and milestones. Software cost-estimation techniques/models. Software quality assurance and metrics for software productivity and quality. Inspections, walkthroughs, and reviews. Approaches to team organization. Configuration management. Automated project management tools. Software maintenance. Information system security. Procurement of software services and systems. Management of operational systems. Legal/ethical issues associated with CIS and software.

MCIS 623 Legal and Ethical Aspects of Computing (3 credits)

Building on a foundation in classical ethics, we examine the impact of the computer and the Internet on our society. Topics covered include ethical decision making; professional codes; whistle-blowing; computer crime; copyrights, patents and intellectual property; privacy; and risk management. Students will analyze case studies and write a research paper.

MCIS 625 Computer Graphics (3 credits)

Principles and concepts of computer graphics useful to information managers. Topics include an introduction to raster graphics, concepts of 2-D and 3-D graphics, modeling, rendering, graphic file formats, color, graphical user interfaces, virtual reality, and the graphical presentation of information.

MCIS 630 Database Systems (3 credits)

Methodologies and principles of database analysis and design are presented. Conceptual modeling and specifications of databases, database design process and tools, functional analysis, the entity-relationship model, and advanced semantic modeling methods are discussed. Topics include theories of database systems, including the architectures of database systems, logical and physical database organizations, data models for database systems (network, hierarchical, relational, and object-oriented model), relational algebra and calculus, query languages, normal forms, null values and partial information, relational database design utilizing dependencies, view design and integration, concurrency control, query optimization, client-server database applications, distributed databases, object-oriented databases, and the current research and development trends of database analysis, design, modeling, and applications.

MCIS 631 Database Systems Project (3 credits)

The techniques of database management systems are applied to practical projects. Prerequisite: MCIS 630.

MCIS 645 Software Engineering (3 credits)

The development of software-intensive systems; software quality factors; software engineering principles; system life-cycle models and paradigms; requirements definition and analysis; behavioral specification; software design; implementation; software testing techniques; verification and validation; system evolution; software project management. This course is only for students in the CIS master's program.

MCIS 650 Data Communications Networks (3 credits)

This course covers the technical concepts of data networks, network components, associated network technologies, and data communications protocols. Specification, design, testing, managing, and updating of data networks from legacy systems through high-speed networks are discussed. Network components, guided and unguided media, as well as routing and high-speed switching systems are studied. This course examines the relationship of computer applications to network architecture and subsystems. Current network and data communication topics are presented, as well as future trends.

MCIS 651 Project in Data Communications Networks (3 credits)

Students pursue a project, research study, or implementation in data communications networks. Prerequisite: MCIS 650.

MCIS 652 Information Security (3 credits)

Concepts and applications of system and data security. Topics include risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy. Areas of particular focus include secure network design, implementation and transition issues, and techniques for responding to security breaches.

MCIS 654 Electronic Commerce on the Internet (3 credits)

The combination of the computer and the Internet have created an incredible "market space". We will examine the foundation, operation and implications of the Internet economy. Topics include Internet technologies, online market mechanisms, interactive customers, knowledge-based products, smart physical products and services, pricing in the internet economy, online auctions and e-marketplaces, digital governance, policies for the internet economy and an outlook for the new economy. Students will participate in an Internet shopping experience, analyze a company that focuses on eCommerce and write a research paper.

MCIS 661 Object-Oriented Applications (3 credits)

Principles and concepts of the object-oriented paradigm and object-oriented programming languages. Notation and techniques for the analysis, design, and implementation of object-oriented systems. Mechanisms for reuse, including composition, inheritance, design patterns, and application frameworks. The use of object-oriented methods in common applications.

MCIS 665 Client-Server Computing (3 credits)

Concepts and principles of client-server architecture, protocols, networks, and distributed computing are presented. The focus of this course is on distributed application design and implementation. Topics include inter-process communication, the role of the GUI and front-end development tools, middleware, multi-tier architectures, distributed objects, and database interaction. Discussions include the various relationships between client-server computing and business processes. Migration from legacy systems is considered along with concerns for meeting customer requirements.

MCIS 670 Artificial Intelligence and Expert Systems (3 credits)

Covers the theory and practice of artificial intelligence and knowledge-based expert systems. Topics discussed include knowledge representation and inference, heuristic and adversary search, genetic algorithms, machine learning, neural computing, reasoning under uncertainty, symbolic programming using Lisp, logic programming using Prolog, and expert systems. Examples from current application areas such as robotics, planning, machine vision, natural language processing, and intelligent agents are used to reinforce the concepts.

MCIS 671 Decision Support Systems (3 credits)

This course examines concepts of decision support in both automated and non-automated environments. The focus is on application of decision theory, analytical modeling, and simulation techniques to solve organizational problems. Group Decision Support Systems, Executive Information Systems, and Expert Systems are also discussed. Case studies of existing systems are used to reinforce concepts discussed in class. A major component of the course is a project entailing the design, implementation, and evaluation of a Decision Support System. Emphasis is placed on the technical aspects of decision support systems.

MCIS 680 Human-Computer Interaction (3 credits)

Focuses on the dynamics of human-computer interaction (HCI). Provides a broad overview of HCI as a sub-area of computer science and explores user-centered design approaches in information systems applications. Addresses the user interface and software design strategies, user experience levels, interaction styles, usability engineering, and collaborative systems technology. Students will perform formal software evaluations and usability tests.

MCIS 681 Multimedia Systems (3 credits)

Introduction to multimedia systems. Definition of terms and concepts related to multimedia. Trends in the development and the use of multimedia. Tools, techniques, and guidelines facilitating the planning, design, production, and implementation of multimedia products.

MCIS 683 Secure Computer Systems (3 credits)

This course will focus on design principles of trusted computing bases (TCB). Issues regarding authentication, access control and authorization, discretionary and mandatory security policies, secure kernel design, secure operating systems, and secure databases will be covered from a systems architecture perspective. Emphasis will be on the design of security measures for critical information infrastructures. Prerequisites: MCIS 615, 630, 650.

MCIS 684 Applied Cryptography (3 credits)

Analysis of cryptographic algorithms, cryptanalysis, symmetric cryptography, public key cryptography, DES, AES, RSA, hash and MAC functions, digital signatures, pseudo-random generators, cryptographic protocols, SSL/TLS, SET. Prerequisites: MCIS 502 (or equivalent), 615, 650.

MCIS 685 Database Security (3 credits)

This course will focus on issues related to the design and implementation of secure data stores. Emphasis will be placed on multilevel security in database systems, covert channels, and security measures for relational and object-oriented database systems. Prerequisites: MCIS 615, 630.

MCIS 686 Advanced Network Security (3 credits)

Fundamental concepts, principles, and practical networking and internetworking issues relevant to the design, analysis, and implementation of enterprise-level trusted networked information systems. Topics include networking

and security architectures, techniques, and protocols at the various layers of the Internet model. Security problems in distributed application environments will be analyzed and solutions discussed and implemented. Prerequisites: MCIS 615, 650.

MCIS 687 Information Security Project (3 credits)

This project course integrates all of the knowledge accumulated through the previous courses and serves as a capstone for the Specialization in Information Security. The class focuses on techniques for protecting critical information infrastructures through case studies, application development, and systems assessment. Students may enroll in this class only after completing all of the information security specialization courses. Prerequisites: MCIS 683, 684, 685, and 686.

MCIS 688 Continuing Thesis in Computer Information Systems (1.5 credits)

Students who have not completed the thesis by the end of the second thesis registration must register for continuing thesis. This allows the student to receive faculty and administrative advice and support related to the thesis. Prerequisite: Completion of second thesis registration.

MCIS 691 Special Topics in Computer Information Systems (3 credits)

This seminar focuses on the professor's current research interests. Requires consent of course professor and program director.

MCIS 699 Master's Thesis in Computer Information Systems (3 credits)

The student develops a framework within which research will be conducted and offers evidence of qualifications to pursue the research. Concepts and theories underlying the student's thesis research are articulated; the problem is clearly stated; specific, measurable goals are specified; a literature review is presented; the methods of conducting research are delineated; and strategy to achieve the goal is given. Registration for MCIS 699 must be repeated for three more credits, for a total of six thesis credits. Prerequisite: Completion of eight courses at the 600-level.

MCIS 1200 Directed Independent Study (3 credits)

Students pursue a project, research study, or implementation under the supervision of a faculty member.

Master of Science (M.S.) in Computer Science

This 36 credit-hour program offers a course of study leading to the master of science (M.S.) in computer science. It is designed to give students a thorough knowledge of the field and to provide an enduring foundation for future professional growth. The program blends theory and practice into a learning experience that develops skills applicable to complex real-world problems. Its formats offer full-time students the opportunity to earn the master's degree in 12 months and working professionals the opportunity to earn the degree in 12–18 months. The curriculum is consistent with recommendations for a model curriculum in computer science as outlined by the Association of Computing Machinery (ACM).

Program-Specific Admission Requirements (See Application for Admission for general requirements.)

This program is designed for students with undergraduate majors in computer science, engineering, mathematics, or physics and who have completed courses or have equivalent experience in data structures and algorithms, assembly language, computer architecture, programming in a modern high-level language, systems software (compilers or operating systems), calculus (differential and integral calculus), and discrete mathematics. Applicants who do not have adequate backgrounds may be required to take one or more of the following 500-level graduate courses during the first two terms of the student's program:

- | | |
|---|---|
| MCIS 500 Assembly Language and Architecture | MCIS 502 Mathematics in Computing |
| MCIS 501 Java Programming Language | MCIS 503 Data Structures and Algorithms |

These are in addition to the required 36 credit hours of courses at the 600 level. Courses at the 500 level, when required, must be completed prior to taking courses at the 600 level; however, some exceptions may be permitted by the program director. MCIS 501 is a prerequisite to MCIS 503.

Early Admission into the Doctoral Program

This option provides the opportunity for master's students in computer science to earn the Ph.D. in computer science or computer information systems in a shorter time. In addition to the requirements for early admission specified in the section General Information on Master's Degree Programs, the student must have completed CISC 610 Programming Languages, CISC 615 Design and Analysis of Algorithms, CISC 630 Compiler Design Theory, and CISC 640 Operating Systems Theory and Design.

The Curriculum for the M.S. in Computer Science

The student may substitute up to two electives for two core courses. Students who wish to take an additional elective must request approval from the program office prior to registration. If the thesis option is elected, two courses may be omitted. Plans for the thesis option must be made with the program office.

Core Courses:

CISC 610 Programming Languages
CISC 615 Design and Analysis of Algorithms
CISC 630 Compiler Design Theory
CISC 640 Operating Systems Theory and Design
CISC 650 Data Communications Networks
CISC 660 Database Management Systems
CISC 665 Client-Server Computing
CISC 670 Artificial Intelligence
CISC 680 Software Engineering
CISC 681 Interactive Computer Graphics
CISC 683 Object-Oriented Design
CISC 685 Human-Computer Interaction

Electives:

CISC 620 Modeling and Simulation
CISC 622 Numerical Analysis
CISC 631 Language Theory and Automata
CISC 632 Compiler Implementation
CISC 644 Operating Systems Implementation
CISC 647 Advanced Computer Architecture
CISC 651 Project in Data Communications Networks
CISC 654 Information Security
CISC 661 Database Management Systems Implementation
CISC 663 Object-Oriented Database Systems
CISC 682 Software Engineering Implementation
CISC 690 Special Topics in Computer Science

Course Descriptions for the M.S. in Computer Science

CISC 610 Programming Languages (3 credits)

Formal languages and language hierarchies, syntactic and semantic specification, abstract machines and corresponding languages, context-free languages, abstraction, modularity, and program structure. Fundamental programming language concepts. Analysis of imperative, object-oriented, and declarative language paradigms. Several programming languages will be analyzed.

CISC 615 Design and Analysis of Algorithms (3 credits)

Topics include sorting, algorithms for tree structures, dynamic programming, greedy methods, advanced data structures, divide and conquer, graph algorithms, arithmetic operations, algorithms for parallel computers, matrix operations, string/pattern matching, network problems, approximation algorithms, and NP-completeness.

MCTE 660 Multimedia Systems (3 credits)

Introduction to multimedia systems. Recent advances and future trends in learning technology and educational computing are examined. Definition of terms and concepts related to multimedia. Trends in the development and the use of multimedia. Tools, techniques, and guidelines facilitating the planning, design, production, and implementation of multimedia products.

MCTE 661 Online Learning Environments (3 credits)

The course explores research trends in the area of online learning. Students will explore the requirements needed for successful online learning and teaching. Topics investigated may include the process of teaching and learning in an OLE, evaluating effective courseware and online communications technologies, integration of technology into OLEs, working with online classroom dynamics, addressing the needs of the online student, making the transition to online teaching, promoting the development of an online learning community, comparing Learning Management Systems (LMSs), and investigating emerging trends in e-learning and e-training in industry settings.

MCTE 670 Learning Theory and Computer Applications (3 credits)

Students will explore learning theories and how learning is achieved when instruction is presented from a computer-based paradigm. The course will emphasize the computer as a learning device that can be used in an effective manner to model learning theories associated with behaviorism, cognitivism, and human information processing.

MCTE 680 Human-Computer Interaction (3 credits)

Explores the field of human-computer interaction (HCI). Investigates the design and usability of educational-related technology. Explores how design practices are integrated with human factors, principles, and methods. Other issues explored may include user experience levels, interaction styles, usability engineering, web design, and future research. Students will perform formal software evaluations and usability tests.

MCTE 688 Continuing Thesis in Computing Technology in Education (1.5 credits)

Students who have not completed the thesis by the end of the second thesis registration must register for continuing thesis. This allows the student to receive faculty and administrative advice and support related to the thesis. Prerequisite: Thesis registrations.

MCTE 690 Research Methodology (3 credits)

This course is an introduction to research, statistical analysis, and decision making. Close attention is paid to data types, data contributions, the identification of variables, and descriptive data presentation techniques. Students are introduced to both parametric and nonparametric data analysis procedures including independent and dependent sample t-tests, chi-square analysis, and simple analysis of variance. Hypothesis testing and the use of statistical software packages are emphasized.

MCTE 691 Master's Project in Computing Technology in Education (3 credits)

This course is the capstone of the program. Each student will develop a comprehensive technology-based project using an environment of choice. Its purpose is to allow students the opportunity to further pursue topics or areas in which they have considerable interest. Each project will be closely mentored by faculty.

MCTE 695 Special Topics in Computing Technology in Education (3 credits)

This seminar focuses on the professor's current research interests. Requires consent of course professor and program director.

MCTE 699 Master's Thesis in Computing Technology in Education (3 credits)

The student develops a framework within which research will be conducted and offers evidence of qualifications to pursue the research. Concepts and theories underlying the student's thesis research are articulated; the problem is clearly stated; specific, measurable goals are specified; a literature review is presented; the methods of conducting research are delineated; and strategy to achieve the goal is given. Registration for MCTE 699 must be repeated for three more credits, for a total of six thesis credits. Prerequisite: Completion of eight courses at the 600-level.

MCTE 1200 Directed Independent Study (3 credits)

Students pursue a project, research study, or implementation under the supervision of a faculty member.

Master of Science (M.S.) in Management Information Systems

This 36 credit-hour program offers a course of study leading to the master of science (M.S.) in management information systems. It focuses on the application of technological concepts of information systems to the collection, retention, and dissemination of information for management planning and decision making. The program concentrates on areas such as project management, decision support systems, computer languages, client-server and distributed computing, database systems, telecommunications, system analysis and design, human-computer interaction, electronic commerce, information security, computer graphics, and multimedia.

The program blends theory and practice into a learning experience that develops skills applicable to complex real-world problems. It is designed to give students a thorough knowledge of the field and to provide an enduring foundation for future professional growth.

The program's formats offer full-time students the opportunity to earn the master's degree in 12 months and working professionals the opportunity to earn the degree in 12–18 months. In addition, students have the option to pursue the M.S. in MIS with *specializations in electronic commerce or information security*. The M.S. in MIS with a specialization in electronic commerce requires 39 credit hours. The M.S. in MIS with a specialization in information security requires 42 credit hours. See the curriculum section below for details on the specializations.

Program-Specific Admission Requirements (See Application for Admission for general requirements.)

This program is designed for students with undergraduate majors in management information systems, computer information systems, business administration, or a related field, and having knowledge and significant experience in computer applications. Experience with the Internet is preferred.

Students who cannot demonstrate competence in programming in a high-level language such as C, C++, or Java must take MMIS 501 Introduction to Java Programming. This course is in addition to the required 36 credit hours at the 600 level. MMIS 501 must be completed prior to taking courses at the 600 level; however, some exceptions may be permitted by the program director.

Early Admission into the Doctoral Program

This option provides the opportunity for master's students in management information systems to earn the Ph.D. in information systems in a shorter time. In addition to the requirements for early admission specified in the section General Information on Master's Degree Programs, the student must have completed MMIS 610 Survey of Computer Languages, MMIS 620 Management Information Systems, MMIS 626 Client-Server and Distributed Computing, MMIS 630 Database Systems, and MMIS 660 Systems Analysis and Design.

The Curriculum for the M.S. in Management Information Systems

Core courses and electives are listed below. Students may substitute up to two electives for two core courses. Students who wish to take an additional elective must request approval from the program office prior to registration. If the thesis option is elected, two courses may be omitted. Plans for the thesis option must be made with the program office. Courses constituting the degree program with specialization in electronic commerce or with specialization in information security are listed below following the electives.

Core Courses:

- MMIS 610 Survey of Computer Languages
- MMIS 620 Management Information Systems
- MMIS 621 Information Systems Project Management
- MMIS 626 Client-Server and Distributed Computing
- MMIS 630 Database Systems
- MMIS 642 Data Warehousing
- MMIS 653 Telecommunications and Computer Networking
- MMIS 654 Electronic Commerce on the Internet
- MMIS 660 Systems Analysis and Design
- MMIS 661 Object-Oriented Applications
- MMIS 671 Decision Support Systems
- MMIS 680 Human-Computer Interaction

Electives:

- MMIS 615 Quantitative Methods
- MMIS 623 Legal and Ethical Aspects of Computing
- MMIS 625 Computer Graphics
- MMIS 631 Database Systems Project
- MMIS 640 System Test and Evaluation
- MMIS 652 Information Security
- MMIS 655 Server-Side Development of eCommerce Applications
- MMIS 656 Web Design Technologies
- MMIS 657 Analysis and Design of eCommerce Application Software
- MMIS 658 Electronic Commerce Project
- MMIS 670 Artificial Intelligence and Expert Systems
- MMIS 681 Multimedia Systems
- MMIS 683 Fundamentals of Security Technologies
- MMIS 684 Information Security Management
- MMIS 685 Information Security Policy, Privacy, and Ethics
- MMIS 686 Information System Auditing and Secure Operations
- MMIS 687 Information Security Project
- MMIS 691 Special Topics in MIS

The M.S. in MIS with Specialization in Electronic Commerce (Required Courses):

- MMIS 620 Management Information Systems
- MMIS 623 Legal and Ethical Aspects of Computing
- MMIS 626 Client-Server and Distributed Computing
- MMIS 630 Database Systems
- MMIS 652 Information Security
- MMIS 653 Telecommunications and Computer Networking
- MMIS 654 Electronic Commerce and the Internet
- MMIS 655 Server-Side Development of eCommerce Applications
- MMIS 656 Web Design Technologies
- MMIS 657 Analysis and Design of eCommerce Application Software
- MMIS 658 Electronic Commerce Project
- MMIS 660 Systems Analysis and Design
- MMIS 680 Human-Computer Interaction

The M.S. in MIS with Specialization in Information Security (Required Courses):

- MMIS 610 Survey of Computer Languages
- MMIS 620 Management Information Systems
- MMIS 621 Information Systems Project Management
- MMIS 626 Client-Server and Distributed Computing
- MMIS 630 Database Systems
- MMIS 653 Telecommunications and Computer Networking
- MMIS 660 Systems Analysis and Design
- MMIS 671 Decision Support Systems
- MMIS 680 Human-Computer Interaction
- MMIS 683 Fundamentals of Security Technologies
- MMIS 684 Information Security Management
- MMIS 685 Information Security Policy, Privacy, and Ethics
- MMIS 686 Information System Auditing and Secure Operations
- MMIS 687 Information Security Project

Course Descriptions for the M.S. in Management Information Systems

MMIS 501 Introduction to Java Programming (3 credits)

This course is an introduction to the Java programming language. The course will include an introduction to the concepts of object-oriented programming and will show how Java supports this programming paradigm. You will learn about the Java environment and will write both applets (programs that execute in a web browser) and applications (stand-alone programs). In addition to learning about basic language statements, you will also learn how Java provides support for such diverse applications as web pages, multimedia, education, etc.

MMIS 610 Survey of Computer Languages (3 credits)

A study of high-level languages, fourth-generation languages, and command languages used in the development of software for management information systems. The logical and physical structure of programs and data. Concepts of structured programming. Data structures, file management, and their use in problem solving. Students will complete a variety of high-level language computer programs.

MMIS 615 Quantitative Methods (3 credits)

An introduction to the basic quantitative tools needed to support problem solving and decision making in the information systems environment. Heavy emphasis is placed on the application of these tools in a case-based, real-world environment.

MMIS 620 Management Information Systems (3 credits)

The application of information system concepts to the collection, retention, and dissemination of information for management planning and decision making. Issues such as personnel selection, budgeting, policy development, and organizational interfacing are discussed. Conceptual foundations and planning and development of management information systems. The role of MIS in an organization and the fit between the system and the organization.

MMIS 621 Information Systems Project Management (3 credits)

Practical examination of how projects can be managed from start to finish. Life-cycle models/paradigms. Life-cycle phases. Project planning and risk analysis. Project control including work breakdown structures, project scheduling, activities and milestones. Software cost estimation techniques and models. Software quality assurance and metrics for software productivity and quality. Inspections, walkthroughs, and reviews. Documentation and configuration management. Automated project management tools. Software maintenance. Procurement of software services and systems and development of IS project specifications. Project management skills including leadership, team building, planning, time management, resource allocation, conflict management, and using IS project management in strategic planning. Ethics in project management. Case studies are used throughout the course to support concepts, principles, and problem solving.

MMIS 623 Legal and Ethical Aspects of Computing (3 credits)

Building on a foundation in classical ethics, we examine the impact of the computer and the Internet on our society. Topics include ethical decision making; professional codes; whistle-blowing; computer crime; copyrights, patents and intellectual property; privacy; and risk management. Students analyze case studies and write a research paper.

MMIS 625 Computer Graphics (3 credits)

Principles and concepts of computer graphics useful to information managers. Topics include an introduction to raster graphics, concepts of 2-D and 3-D graphics, modeling, rendering, graphic file formats, color, graphical user interfaces and virtual reality, and the graphical presentation of information.

MMIS 626 Client-Server and Distributed Computing (3 credits)

Included in this course are a wide range of issues, methods, techniques, and case examples for developing and managing client-server and distributed systems. These include client-server development using RAD methodologies, transaction process monitors, types of aboveware and middleware, middleware standards (DCE, RPC, and CORBA), managing client-server environments, software installation and distribution, electronic mail architectures in client-server systems, evaluation of vendor strategies, issues in selecting client-server products, legacy system migration issues, interoperability, scalability, network and security concerns, the emerging desktop standards, the role of network computers and thin clients, and the emergence of the web as an extension of the client-server environment.

MMIS 630 Database Systems (3 credits)

The application of database concepts to management information systems. Design objectives, methods, costs, and benefits associated with the use of a database management system. Tools and techniques for the management of large amounts of data. Database design, performance, and administration. File organization and access methods. The architectures of database systems, data models for database systems (network, hierarchical, relational, and object-oriented model), client-server database applications, distributed databases, and object-oriented databases.

MMIS 631 Database Systems Project (3 credits)

The techniques of database management systems will be applied to practical projects. Prerequisite: MMIS 630.

MMIS 640 System Test and Evaluation (3 credits)

An analysis of the verification and validation process. Methods, procedures, and techniques for integration and acceptance testing. Reliability measurement. Goals for testing. Testing in the small and testing in the large. Allocation of testing resources. When to stop testing. Test case design methods. Black box software testing techniques including equivalence partitioning, boundary-value analysis, cause-effect graphing, and error guessing. White box software testing techniques including statement coverage criterion, edge coverage criterion, condition coverage criterion, and path coverage criterion. Test of concurrent and real-time systems.

MMIS 642 Data Warehousing (3 credits)

This course includes the various factors involved in developing data warehouses and data marts: planning, design, implementation, and evaluation; review of vendor data warehouse products; cases involving contemporary implementations in business, government, and industry; techniques for maximizing effectiveness through OLAP and data mining.

MMIS 652 Information Security (3 credits)

Concepts and principles of system and data security. Risk assessment, evaluation of vulnerabilities, policy formation, control and protection methods. Review and evaluation of security models. Issues in physical, system, network, database and application security. Protection methods of encryption, authentication technologies, and access control are used to examine host-based and network-based security issues. Management of security, policy formulation, security personnel and issues of law and legal protection of privacy. System design and network design for security and techniques for combating security breaches.

MMIS 653 Telecommunications and Computer Networking (3 credits)

This course provides a framework for understanding telecommunications fundamentals and computer network functionality, characteristics, and configurations. Topics include wire-free and wire-based communications; network topologies, protocols, and architectures; emerging trends in network technologies and services; and the role of ISDN (Integrated Services Digital Network) and ATM (Asynchronous Transfer Mode) in the corporate environment. Strategies for network planning, implementation, and management are introduced. Recent advances in standardization, internetworking, and deployment of LANs (local area networks), MANs (metropolitan area networks), and WANs (wide area networks) are examined.

MMIS 654 Electronic Commerce on the Internet (3 credits)

The combination of the computer and the Internet have created an incredible "market space". We will examine the foundation, operation and implications of the Internet economy. Topics include Internet technologies, online market

mechanisms, interactive customers, knowledge-based products, smart physical products and services, pricing in the internet economy, online auctions and e-marketplaces, digital governance, policies for the internet economy and an outlook for the new economy. Students will participate in an Internet shopping experience, analyze a company that focuses on eCommerce and write a research paper.

MMIS 655 Server-Side Development of eCommerce Applications (3 credits)

A variety of web applications such as storefronts, electronic communities, electronic markets, and on-line auction systems are studied. Topics covered include server-side scripting using a scripting language, introductory systems analysis and design for electronic commerce applications, and web-database integration. Prerequisites: MMIS 630, 656.

MMIS 656 Web Design Technologies (3 credits)

A hands-on introduction to a variety of technologies involved in the design of web sites. Topics include aligning electronic business models with web site design, planning a web site, understanding the principles and elements of effective web site design, using web development and design tools, and evaluating web site effectiveness.

MMIS 657 Analysis and Design of eCommerce Application Software (3 credits)

This course focuses on the analysis, design and implementation of B2C and B2B eCommerce applications. Studied are several building blocks for eCommerce application development including XML, web services and specific web application frameworks. Prerequisite: MMIS 655.

MMIS 658 Electronic Commerce Project (3 credits)

This course integrates the knowledge accumulated through the previous courses in the eCommerce specialization. It focuses on best practices in analysis, design and implementation of eCommerce applications and uses case studies. The principal component of this course is the course project. Working either individually or in teams, students work on the course project, which requires a comprehensive analysis, design and implementation of an eCommerce application. Prerequisites: MMIS 655, 656, 657.

MMIS 660 Systems Analysis and Design (3 credits)

Analysis of requirements for information systems. Elicitation/fact-finding, problem analysis, decomposition, and the requirements document. Concepts, methods, techniques, and tools for systems analysis, modeling and simulation, and prototyping. Structured and object-oriented analysis. Role of the systems analyst in the organization. Gaining user commitment and fulfilling user needs. Concepts, tools, and techniques for systems design. Design principles, quality factors, decomposition of complex systems, and modularization techniques. Design methods such as object-oriented and function-oriented design. Comparison of analysis and design techniques.

MMIS 661 Object-Oriented Applications (3 credits)

Principles and concepts of the object-oriented paradigm and object-oriented programming languages. Notation and techniques for the analysis, design, and implementation of object-oriented systems. Mechanisms for reuse, including composition, inheritance, design patterns, and application frameworks. The use of object-oriented methods in common applications.

MMIS 670 Artificial Intelligence and Expert Systems (3 credits)

Theory and practice of artificial intelligence and knowledge-based expert systems. Topics include knowledge representation and inference, heuristic search, genetic algorithms, machine learning, neural computing, reasoning under uncertainty, and expert systems. Symbolic programming using Lisp and logic programming using Prolog. Examples from current application areas such as robotics, planning, machine vision, natural language processing, and intelligent agents are used to reinforce the concepts.

MMIS 671 Decision Support Systems (3 credits)

This course examines concepts of decision support in both automated and non-automated environments. The focus is on application of decision theory, analytical modeling, and simulation techniques to solve organizational problems. Group Decision Support Systems, Executive Information Systems, and Expert Systems are also discussed. Case studies of existing systems are used to reinforce concepts discussed in class. A major component of the course is a project entailing the design, implementation, and evaluation of a Decision Support System.

MMIS 680 Human-Computer Interaction (3 credits)

The dynamics of human-computer interaction (HCI). Provides a broad overview and offers specific background relating to user-centered design approaches in information systems applications. Areas to be addressed include the user interface and software design strategies, user experience levels, interaction styles, usability engineering, and collaborative systems technology. Students will perform formal software evaluations and usability tests.

MMIS 681 Multimedia Systems (3 credits)

Introduction to multimedia systems. Definitions of terms and concepts related to multimedia. Trends in the development and the use of multimedia. Tools, techniques, and guidelines facilitating the planning, design, production, and implementation of multimedia products.

MMIS 683 Fundamentals of Security Technologies (3 credits)

This course investigates fundamental assurance technologies that can be applied to interface specifications, architectures, and implementations of information security mechanisms. Principles of testing are discussed and applied to demonstrative and vulnerability testing. The selection of appropriate security applications, security lifecycles, and interoperability issues will also be covered. Prerequisites: MMIS 610, 626.

MMIS 684 Information Security Management (3 credits)

This course will integrate concepts and techniques from management and organizational behavior in order to identify, understand, and propose solutions to the problems of computer security and security administration. Particular focus will be on the role of managers in the security process and the development of effective policies and procedures. Prerequisites: MMIS 620, 621.

MMIS 685 Information Security Policy, Privacy, and Ethics (3 credits)

This course will cover the development and need for information security policies, issues regarding privacy, and the application of computer ethics. The course will also focus on legal issues and legislation that impacts the design, implementation, and administration of secure infrastructures. Prerequisite: MMIS 620.

MMIS 686 Information Systems Auditing and Secure Operations (3 credits)

Information security ultimately depends upon correct usage of available security features. This course covers principles and practice related to secure operation of existing information technology. Topics related to security auditing and accountability will also be discussed. Prerequisites: MMIS 620, 621.

MMIS 687 Information Security Project (3 credits)

This project course integrates all of the knowledge accumulated through the previous courses and serves as a capstone for the Specialization in Information Security. The class focuses on best practices demonstrated through case studies and systems assessment. Students may enroll in this class only after completing all of the information security specialization courses. Prerequisites: MMIS 683, 684, 685, and 686.

MMIS 688 Continuing Thesis in Management Information Systems (1.5 credits)

Students who have not completed the thesis by the end of the second thesis registration must register for continuing thesis. This allows the student to receive faculty and administrative advice and support related to the thesis. Prerequisite: Completion of second thesis registration.

MMIS 691 Special Topics in Management Information Systems (3 credits)

This seminar focuses on the professor's current research interests. Requires consent of course professor and program director.

MMIS 699 Master's Thesis in Management Information Systems (3 credits)

The student develops a framework within which research will be conducted and offers evidence of qualifications to pursue the research. Concepts and theories underlying the student's thesis research are articulated; the problem is clearly stated; specific, measurable goals are specified; a literature review is presented; the methods of conducting research are delineated; and strategy to achieve the goal is given. Registration for MMIS 699 must be repeated for three more credits, for a total of six thesis credits. Prerequisite: Completion of eight courses at the 600-level.

MMIS 1200 Directed Independent Study (3 credits)

Students pursue a project, research study, or implementation under the supervision of a faculty member.

Doctoral Degree Programs

General Information on Doctoral Degree Programs

Application for Admission

Admission is competitive; consequently applicants who meet the minimum requirements specified herein are not assured admission. The school qualitatively and quantitatively evaluates applicants and makes selections based on performance, personal qualifications, and evidence of potential for success. Admission decisions are made on a rolling basis. Applications will be reviewed by the Admissions Committee after the following items have been received by the admissions office: application form, application fee, essay, résumé, three evaluation forms, and all transcripts (unofficial copies are acceptable pending receipt of official transcripts). To ensure evaluation for the desired starting term applications must be received at least one month prior to the start of that term.

Late applications that cannot be processed in time for the desired starting term will be considered for the next term. Newly admitted students must register within two years from the date of their first possible registration. Failure to do so will require a formal petition for readmission. Applicants must meet the requirements and submit the items specified below and must also satisfy the program-specific admission requirements contained in the individual program sections of this catalog. Detailed instructions for the preparation of admission materials are contained in the admission forms which may be downloaded from the school's website: http://www.scis.nova.edu/NSS/pdf_documents/index.html. For additional information, contact:

Graduate School of Computer and Information Sciences Tel: 800-986-2247 or 954-262-2000
Nova Southeastern University Email: <mailto:scisinfo@nova.edu>
3301 College Avenue Website: <http://www.scis.nova.edu>
Fort Lauderdale, Florida 33314-7796

Minimum Admission Requirements

1. An earned master's degree with a GPA of at least 3.25 from a regionally accredited institution with an appropriate major (see program-specific admission requirements under individual programs). Alternatively, SCIS master's degree students may apply for early admission into the doctoral program with the same major (see the section Master's Degree Programs for requirements).
2. Application form, application fee, and essay.
3. Official transcripts of all graduate and undergraduate education.
4. Evaluation forms from three people who are familiar with your academic and/or professional capabilities and can assess your intellectual abilities, maturity, and motivation. Forms from your professors are preferred. Forms from family members or those unable to evaluate your academic potential are unacceptable.
5. A résumé (short account of one's career and qualifications).
6. Proficiency in the English language. Doctoral students are expected to write numerous papers and a dissertation. Grammatical errors, spelling errors, and writing that does not express ideas clearly will affect a student's grades and the completion of his or her degree. The faculty will not provide remedial help concerning grammatical errors or other writing problems. Applicants who are unable to write correctly and clearly are urged to seek remedial help before enrolling in any of the school's programs.

program office in concert with the faculty. Students are offered dissertation counseling throughout the program.

Registration

The registration process begins when the program director sends an email to students' NSU email accounts informing them of registration for the upcoming term. Registration materials are also posted on the doctoral website: <http://www.scis.nova.edu/Doctoral/index2.html>. Students can confirm their registration status by accessing Webstar at <http://webstar.nova.edu>. Students are expected to register during the published registration period. Registration after the close of the published registration period, when permitted, will require the payment of a late fee.

Drop/Add Period

Failure to attend or participate in a class does not automatically drop or withdraw a student from the class. Registered doctoral students may drop/add a course prior to the first day of the term and up to and including the second day of classes (the drop/add period) without penalty. If a course is dropped between the first day of the term and the end of the drop/add period and another course is not added in its place, the withdrawal policy applies.

Refund Policy Regarding Withdrawals (Also see the section Grade Policy Regarding Withdrawals.)

A student withdrawing from a course may be eligible for a refund (full or partial) of tuition paid (not including fees) depending on the date of withdrawal. Course withdrawal requests must be submitted to the program office in writing (via postal mail or email) by the student. Withdrawals sent by email must be sent from the student's assigned NSU email account and must clearly identify the student. Requests for withdrawal must be received by the program office at least three weeks prior to the last day of the term. Failure to attend class or participate in class activities will not automatically withdraw a student from the class. Students withdrawing between the first and the 15th calendar day of the term will receive a 90 percent refund of tuition paid. Students withdrawing between the 16th and the 38th calendar day of the term will receive a 50 percent refund of tuition paid. Students withdrawing between the 39th and the 76th calendar day of the term will receive a 25 percent refund of tuition paid. Students withdrawing after the 76th calendar day of the term will receive no refund. If a student is using one of the payment plans on p. 6, the tuition due or the amount refunded will be adjusted accordingly.

Form and Style Requirements for Student Work

Doctoral students must follow the policies, procedures, and formatting requirements contained in the school's *Dissertation Guide* (2003) for the planning and preparation of the doctoral dissertation. For reference citations and reference lists students must follow the instructions given in the *Dissertation Guide*. Doctoral students may find the *Dissertation Guide* helpful in the preparation of other work. For an individual course, the course professor will specify form and style requirements in the course syllabus. There are several books that provide general guidelines for form, style, and general writing principles in the preparation of papers, assignments, and reports. *On Writing Well* (Zinsser, 2001) is an excellent guide to clear, logical, and organized writing. *Bugs in Writing* (Dupré, 1998) contains valuable guidance on professional writing and is oriented to the computer and information sciences. The *Publication Manual of the American Psychological Association, Fifth Edition* (2001) addresses editorial style, grammar, and organization, and its use is often required by course professors.

Attendance Policy

Doctoral degree students are required to attend all of their scheduled clusters or institutes. Students are cautioned that they risk withdrawal from courses and suspension or dismissal from the doctoral program should they miss institutes or clusters. Exceptions to this rule may be made in the case of illness and possibly in other hardship situations. Such exceptions must be approved first by the course professor and then by the program director. Absence from individual class sessions must be approved by the course professor. Students are required to advise the program office and their course professor in advance of any anticipated absences. Participation/attendance policies regarding the online components of doctoral courses will be covered in the syllabus of each course.

Academic Progress, Grade Requirements, and Academic Standing

Failure to achieve academic progress in two continuous terms of registration will subject the student to review by the Academic Review Committee and possible dismissal. Each student must maintain a cumulative grade point average (GPA) of at least 3.0 to remain in good academic standing. When the cumulative GPA falls below 3.0 the student is automatically placed on academic probation and will not be permitted to graduate. (Academic probation may adversely affect financial aid.) If the cumulative GPA is not raised to 3.0 within one term the student may be dismissed from the program. Upon achieving a cumulative GPA of 3.0, the student will be removed from academic probation. If the cumulative GPA could not be raised to 3.0 within the required period the student will be dismissed immediately. Students with a history of withdrawals risk dismissal. Students who receive two grades of F will be dismissed immediately. Students who do not make progress toward the completion of a dissertation will be evaluated for probation or dismissal (see the section Evaluation of Dissertation Progress). Students who do not have a cumulative GPA of 3.0 at the end of their course work will not be admitted to candidacy and will not be permitted to register for dissertation.

Time Limitations

Students must complete requirements for the degree within seven years from the date of their first registration. Students desiring an extension of time must petition the program office in writing at least one month before the time limit is reached. In the absence of a petition for extension, the student will be automatically dismissed from the program. Only the dean can grant an extension. Extensions are granted reluctantly and only when it is believed that the student is very close to finishing the dissertation and when the knowledge the student gains from the program will be contemporary.

For a petition to be considered the following conditions must be met: (1) The student must be in the final report stage of the dissertation; (2) the dissertation advisor, committee members, and program director must support the petition; and (3) there must be a high probability that the student will complete the final dissertation report within three to six months of the date of the petition for extension. Students close to reaching the seven year time limit but who do not meet the above conditions may petition the program office in writing for readmission. Such petitions must be received at least one month before the time limit is reached. Readmission is a process whereby exceptional doctoral students may be granted a new time limit to complete the degree. A student who applies for readmission will be reviewed by a faculty committee that will present a recommendation to the dean. A petition for readmission will be considered when the following conditions are met: (1) The student has an approved idea paper and a dissertation advisor; and (2) the dissertation advisor and the program director support the petition. The faculty committee will decide if the student has the potential to complete a dissertation. Recommendations to the dean that are favorable will include a new time limit and may contain other requirements such as taking additional courses to ensure that the knowledge the student gains from the program will be contemporary.

Independent-Study Basis, Directed Independent Study, or Taking a Course in Another Program

Each of these requires the student to submit a request for approval to the Director of Graduate Programs prior to registration. *Independent-study basis* means taking a course that is published in the curriculum of the program under which the student is enrolled but is not currently offered (it would be taken under the supervision of a faculty member). The student would register for the course prefix and number listed in the curriculum. *Directed independent study* means working on a project or study under the supervision of a faculty member in an area not covered by a course in the published curriculum. The student would register for the course <Prefix> 1200 *Directed Independent Study* (the prefix would identify the student's program). *Taking a course in another program* means taking a course in one of the school's doctoral programs in which the student is not enrolled. For each of these cases, the program director will review the student's record to determine the appropriateness of the request. If the request appears to be consistent with the student's program and school policies, the director will consult with the appropriate faculty member for possible approval and will notify the student of the decision and any requirements.

The Dissertation

Students will be permitted to register for the dissertation after they have completed their required course work with a minimum cumulative GPA of 3.0. Both Dissertation I and Dissertation II are required. They are usually taken over two consecutive terms. The dissertation is the most important requirement for the doctoral degree. Each student is expected, with the approval of a faculty advisor, to select an appropriate topic of sufficient scope to satisfy the requirements for the dissertation. Although registration for dissertation credits typically occurs at or near the end of completion of the course requirements, students are encouraged to learn about the dissertation process as early as possible and to begin talking with faculty members about potential research topics early in the program.

The dissertation must be an original work and must represent a significant extrapolation from a base of solid experience or knowledge in the student's area of concentration. Dissertation results must, in a significant way, advance knowledge, improve professional practice, or contribute to understanding in the field of study. Results must be of sufficient strength to distill from the work a paper worthy of publication in a journal or conference proceedings, or to use the work as the basis of a textbook or monograph. Although publication is not a requirement for completing the doctoral degree, students are encouraged to submit their dissertation research for publication. Doctoral students must follow the policies, procedures, and formatting requirements contained in the *SCIS Dissertation Guide*. It is recommended that students attend cluster and institute presentations on the dissertation process, research methodology, and writing for publication.

Evaluation of Dissertation Progress

Each student is evaluated on a number of occasions regarding his or her dissertation progress. The purpose of such evaluation is to provide students with relevant and timely feedback concerning their overall performance in the dissertation process and to serve as a screening procedure. Failure to demonstrate the ability to complete a dissertation or to maintain satisfactory progress on the dissertation may result in review by the Academic Review Committee and possible probation, suspension, or dismissal from the doctoral program. Each student must demonstrate proficiency in the use of the English language in all work submitted during the dissertation process. Grammatical errors, spelling errors, and writing that does not express ideas clearly will not be tolerated and may result in the rejection of dissertation work and review by the Academic Review Committee. The faculty will not provide remedial help concerning grammatical errors or other writing problems that students might have. Students who are unable to write correctly and clearly are urged to obtain remedial help.

Tuition and Fees for Doctoral Programs (See sections Tuition Payment Policy and Financial Aid.)

Academic, program, and online services are provided only to SCIS students who are currently registered. Students who are not registered are not entitled to receive services. Textbooks are not included in tuition and fees and must be purchased by the student. Students are responsible for their own lodging and travel expenses. Students must be registered to gain access to NSU's computing services. Doctoral students must be registered for courses, projects, dissertation, or continuing dissertation to receive the support of the faculty on the dissertation process.

Course Work	\$475 per credit hour
Dissertation I or II	\$5,100 per term (\$425 per credit hour)
Continuing Dissertation	\$2,550 per term (\$425 per credit hour)
Application Fee	\$50 nonrefundable
Registration Fee	\$30 nonrefundable
Materials Fee.....	\$20 per 700-level course
Late Registration Fee.....	\$100 nonrefundable
Readmission Fee	\$50 nonrefundable
Program Change Fee	\$50 nonrefundable
Graduation Fee.....	\$75
Fee for Installment Payment.....	\$50

Teaching Assistantship Program

The school has a limited number of teaching assistantship positions. To be considered for a teaching assistantship, candidates must have a master's degree in a related field, must be a student in an SCIS doctoral program, and must have earned 18 doctoral credits. Teaching assistants will spend from 20 to 30 hours per week at the university. The assistantship program includes tuition and fees; however, other expenses, e.g., books, are not included. Medical insurance is available under the monthly employee plan. Residence within daily commuting distance to the campus is required. Each award includes a one-year renewable contract with renewal based on faculty evaluation. Teaching assistants may teach courses, assist faculty members with course work, counsel students, conduct literature searches, assist in the preparation of course syllabi, evaluate textbooks, grade papers and projects, and participate in technical/research projects. Interested SCIS doctoral students must submit an application, including an up-to-date curriculum vita, cover letter, and arrange for submission of SCIS evaluation forms by three SCIS faculty members. The application form may be downloaded from the school's website.

Ph.D. Program in Computer Information Systems

This program offers a course of study leading to the degree of doctor of philosophy (Ph.D.) in computer information systems. It is offered in the cluster format, which combines traditional and online instruction to provide professionals the opportunity to pursue graduate study while continuing to work in their current positions. The program is especially well suited to professionals in business, government, industry, or education who are involved with research, design, implementation, management, evaluation, utilization, or teaching of computer information systems. It provides technology-oriented professionals with the knowledge and ability to develop creative solutions to substantive real-world problems. Each student must complete eight courses, four projects, and a dissertation.

Program-Specific Admission Requirements (See Application for Admission for general requirements.)

This program is designed for the student with a master's degree in computer information systems, computer science, or a closely related field. The applicant should satisfy graduate prerequisites or have equivalent experience in information systems, programming languages, database systems, systems analysis and design, data communications and networks, and computer architecture. Alternatively, SCIS

master's students in computer science or computer information systems may apply for early admission into the Ph.D. program. (For details, see sections on early admission under Master's Degree Programs.)

The Curriculum for the Ph.D. in Computer Information Systems

The program requires 64 credit hours, of which 40 are for courses and 24 are for the dissertation. Most students take two core courses and one project course per term during the first two years and register for the dissertation in the third year. Core courses, project courses, and dissertation registrations are listed below:

Core Courses (three credits each) (Select eight of these.)

- DCIS 710 Decision Support Systems
- DCIS 720 Human-Computer Interaction
- DCIS 730 Information Security
- DCIS 735 Knowledge Management
- DCIS 740 Data Communications and Computer Networking
- DCIS 750 Database Systems
- DCIS 760 Artificial Intelligence and Expert Systems
- DCIS 770 Software Engineering
- DCIS 780 Multimedia Systems
- DCIS 790 Special Topics in Computer Information Systems (offered on various subjects)
- DCIS 791 Distributed Systems

Project Courses (four credits each) (Select four of these. Must be taken concurrent with, or following completion of, the corresponding core course.)

- DCIS 810 Project in Decision Support Systems
- DCIS 820 Project in Human-Computer Interaction
- DCIS 830 Project in Information Security
- DCIS 835 Project in Knowledge Management
- DCIS 840 Project in Data Communications and Computer Networking
- DCIS 850 Project in Database Systems
- DCIS 860 Project in Artificial Intelligence and Expert Systems
- DCIS 870 Project in Software Engineering
- DCIS 880 Project in Multimedia Systems
- DCIS 890 Project in Special Topics in Computer Information Systems
- DCIS 891 Project in Distributed Systems

Dissertation Registrations

- DCIS 910 Dissertation I (12 credits)
- DCIS 915 Dissertation II (12 credits)
- DCIS 920 Continuing Dissertation (6 credits)

Course Descriptions for the Ph.D. in Computer Information Systems

DCIS 710 Decision Support Systems (3 credits)

Principles and techniques relating to automated support for decision making and organizational problem solving. Topics include decision theory, modeling and simulation, decision support system architecture, group decision support systems, knowledge-based expert systems, and intelligent systems.

DCIS 720 Human-Computer Interaction (3 credits)

Issues relating to effective human-computer interaction are presented. Basic elements, procedures, tools, and environments contributing to the development of successful user interfaces are explored. User interface design principles, guidelines, and methodologies are reviewed. Other topics include multidisciplinary dynamics of human-computer interaction as a field of study, current and projected developments in HCI research, and usability engineering.

DCIS 730 Information Security (3 credits)

Study of the theory, mechanisms, and implementation of information security and data protection. Topics include formal models for computer security, secure operating systems, mechanisms for mandatory and discretionary controls, distributed secure system architectures, encryption and authentication, access control, integrity models and mechanisms, and programming and vulnerability analysis. An emphasis will be placed on current issues, future directions, and research areas.

DCIS 735 Knowledge Management (3 credits)

Knowledge management (KM) is said to promote innovation, improve efficiency and effectiveness, and provide a sustainable competitive advantage in today's global environment. This course examines computer-based systems for supporting KM. Principles of developing systems for KM are explored. System architectures, tools and techniques, and their use in capturing, storing, locating, evaluating, disseminating, and using information and knowledge are examined. Topics will include techniques for indexing, searching, retrieving, and displaying information from knowledge bases. Investigation of the issues in the application of knowledge management to organizational learning and decision making is included. Application of these principles and techniques through the use of rapidly evolving information/communication technologies is studied in the context of their impact on organizations.

DCIS 740 Data Communications and Computer Networking (3 credits)

Recent advances and new applications in the expanding field of telecommunications and computer networks are examined. The technical fundamentals, architecture, and design of computer networks are described. Strategies, tools, and techniques for network planning, implementation, management, maintenance, and security are delineated. Topics include the OSI Model, TCP/IP, transmission media, network operating systems, topologies, configurations, protocols, and performance characteristics. Trends in standardization, internetworking, downsizing, and the development of networks are explored. The emphasis of the material for this class will be in the analysis, design, development, and management of network systems. The theory behind each component will be presented while exploring the design and development of data and computer networks.

DCIS 750 Database Systems (3 credits)

Theory and principles of databases and their management. Design, implementation, and traditional and nontraditional applications of database management systems. An emphasis will be placed on current issues, future directions, and research topics.

DCIS 760 Artificial Intelligence and Expert Systems (3 credits)

Theory of, and major approaches to, artificial intelligence. Topics include knowledge representation, heuristic search, artificial neural networks, machine learning, intelligent agents, and knowledge-based systems.

DCIS 770 Software Engineering (3 credits)

Covers advanced topics in the development of software-intensive systems, system life cycles, requirements definition and analysis, behavioral specification, design, implementation, verification and validation, system evolution, and project management. An emphasis will be placed on current issues, future directions, and research topics.

DCIS 780 Multimedia Systems (3 credits)

A course in advanced systems covering both theoretical and practical issues in designing multimedia systems. Topics include introduction to multimedia systems, compression techniques, synchronization, user interface issues, storage, video indexing and retrieval techniques, operating system support for digital audio and video, as well as network and transport protocols for multimedia. Emphasis on current design issues, research topics, software implementation, and discussion of future directions.

DCIS 790 Special Topics in Computer Information Systems (3 credits)

Covers advanced topics in areas of current research interest in computer information systems. May include topics such as client-server computing, distributed database systems, advanced computer graphics, object-oriented technology, the integration of networks and operating systems, and parallel computation. Topics will vary depending on student and faculty interest.

DCIS 791 Distributed Systems (3 credits)

Students are expected to contribute to the expansion of the client-server and distributed system paradigms. Topics include the components of client-server and distributed systems architecture, operating systems, networking, interprocess communication, user interface, middleware, distributed objects, groupware, security, and software development. The role of standards in client-server and distributed systems development is discussed, including a detailed study of protocols. Development of the client-server computing model and the application to business process reengineering. Migration from legacy systems is considered along with project development and management. The emphasis of the material for this class will be in the analysis, design, development, and management of client-server and distributed systems. The theory behind each component will be presented while exploring the design and development of client-server and distributed systems.

DCIS 810 Project in Decision Support Systems (4 credits)

Students advance their knowledge through the completion of a research paper or project in the area of decision support systems. Some topics of current interest include model management, investigation of decision support aids, knowledge-based systems and intelligent systems, group DSS, and distributed DSS.

DCIS 820 Project in Human-Computer Interaction (4 credits)

Students produce a research paper or project on a current topic in HCI. Some topics of current interest include interface quality and evaluation, computer system and computer interface architecture, user and task analysis, advancements in usability engineering, Internet-based user interface design issues, legal and ethical aspects of computing, speech interfaces, agent technology, handheld and wearable technology, and computer-supported cooperative work.

DCIS 830 Project in Information Security (4 credits)

Students pursue a research project or implementation on a current topic in information security and assurance. Topics of current interest include secure operating systems and networks, intrusion detection, cryptographic theory and applications, vulnerability analysis, and malicious code detection.

DCIS 835 Project in Knowledge Management (4 credits)

Students pursue a research study, project, or implementation in knowledge management.

DCIS 840 Project in Data Communications and Computer Networking (4 credits)

Students will advance their data communications and computer networking knowledge through the completion of a research paper or project. Some topics of current interest include protocol development and comparisons, the relationship between networks and applications, QoS, network operating systems, and security.

DCIS 850 Project in Database Systems (4 credits)

Students pursue a research study on a current topic in database systems or complete a database-oriented development project. Some areas of current interest include object-oriented database systems, extended relational DBMS, federated or heterogeneous database systems, high-performance parallel database systems, and advanced conceptual logic database modeling.

DCIS 860 Project in Artificial Intelligence and Expert Systems (4 credits)

Students pursue a research or development project in artificial intelligence. Some topics of current interest are artificial life, learning technologies (including symbolic learning, neural networks, and genetic algorithms), intelligent agents, natural language processing, deep domain models in expert systems, vision, speech recognition, handwriting recognition, and parallel and distributed artificial intelligence.

DCIS 870 Project in Software Engineering (4 credits)

Students pursue a research project in a current topic in software engineering or complete a software engineering development project. Some topics of current interest include object-oriented analysis and design, software/system life cycles, reusability, specification, and verification.

DCIS 880 Project in Multimedia Systems (4 credits)

Students pursue a research study or project on a current topic in multimedia systems applicable to their field of study.

DCIS 890 Project in Special Topics in Computer Information Systems (4 credits)

Students pursue a research study, project, or implementation related to DCIS 790.

DCIS 891 Project in Distributed Systems (4 credits)

Students will advance their client-server/distributed systems knowledge through the completion of a research paper or project. Some topics of current interest include distributed object technology, QoS middleware, operating systems, and groupware.

DCIS 910 Dissertation I (12 credits)

The student develops a framework within which doctoral research will be conducted and offers evidence of qualifications to pursue the research. Prerequisite: Satisfactory completion of all course work.

DCIS 915 Dissertation II (12 credits)

Concepts and theories underlying the student's doctoral research are articulated; the problem is clearly stated; specific, measurable goals are specified; a thorough literature review is presented; the methods of conducting the research are delineated and a strategy to achieve the goal is given. Prerequisite: Dissertation I.

DCIS 920 Continuing Dissertation (6 credits)

Students who have not completed the dissertation by the end of Dissertation II must register for Continuing Dissertation each term in order to receive faculty and administrative advice and support related to the dissertation. Prerequisite: Dissertation II.

DCIS 1200 Directed Independent Study (3 credits or 4 credits)

Involves directed readings, research, and creative activities under the supervision of a faculty member. A contract for independent study must be prepared by the student, include an assignment timeline, and be approved by the mentoring faculty member and the program director. (See the section Independent-Study Basis, Directed Independent Study, or Taking a Course in Another Program)

Ph.D. Program in Computer Science

This program offers a course of study leading to the degree of doctor of philosophy (Ph.D.) in computer science. It is offered in the cluster format, which combines traditional and online instruction to give professionals the opportunity to pursue graduate study while continuing to work in their current positions. The program is especially well suited to those in industry, education, or government who are involved with one of the many areas of computer science. It provides research-oriented professionals with knowledge in the major areas of computer science and the ability to develop creative solutions to substantive real-world problems. Each student must complete eight courses, four projects, and a dissertation.

Program-Specific Admission Requirements (See Application for Admission for general requirements.)

This program is designed for the student with a master's degree in computer science, or a closely related field. The applicant should satisfy graduate prerequisites or have equivalent experience in programming languages, data communications and computer networks, operating systems, compilers, database management systems, theory of computation, design and analysis of algorithms, and computer architecture. Alternatively, SCIS master's students may apply for early admission into the Ph.D. program. (For details, see sections on early admission under Master's Degree Programs.)

The Curriculum for the Ph.D. in Computer Science

The program requires 64 credit hours, of which 40 are for courses and 24 are for the dissertation. Most students take two core courses and one project course per term during the first two years and register for the dissertation in the third year. Core courses, project courses, and dissertation registrations are listed below:

Core Courses (three credits each) (Select eight of these.)

CISD 700 Theory and Principles of Programming

CISD 730 Operating Systems

CISD 740 Data Communications and Computer Networking

CISD 750 Database Management Systems

CISD 760 Artificial Intelligence

CISD 770 Software Engineering

CISD 790 Special Topics in Computer Science (offered on various subjects; may take up to two of these)

CISD 792 Computer Graphics

CISD 794 Knowledge Discovery in Databases

Project Courses (four credits each) (Select four of these. Must be taken concurrently with, or following completion of, the corresponding core course.)

CISD 800 Project in Theory and Principles of Programming

CISD 830 Project in Operating Systems

CISD 840 Project in Data Communications and Computer Networking

CISD 850 Project in Database Management Systems

CISD 860 Project in Artificial Intelligence

CISD 870 Project in Software Engineering

CISD 890 Project in Special Topics in Computer Science

CISD 892 Project in Computer Graphics

CISD 894 Project in Knowledge Discovery in Databases

Dissertation Registrations

CISD 910 Dissertation I (12 credits)

CISD 915 Dissertation II (12 credits)

CISD 920 Continuing Dissertation (6 credits)

Course Descriptions for the Ph.D. in Computer Science

CISD 700 Theory and Principles of Programming (3 credits)

Covers advanced topics in areas of current research interest in programming languages, semantics, visual languages, and compiler design for contemporary systems and applications.

CISD 730 Operating Systems (3 credits)

Recent advances in the theory and practice of state-of-the-art methods in the structure and development of operating systems. Topics include operating system architectures, object-oriented operating systems, distributed operating systems, real-time issues, performance, and software engineering issues in the development of an operating system. An emphasis will be placed on current issues, future directions, and research topics.

CISD 740 Data Communications and Computer Networking (3 credits)

Study of data communications and network theory, design, and implementation. Topics include network architectures, transmission encoding, direct-link networks, switching, routing, network analysis, network algorithms, internetworking, addressing, name services, security, data compression, congestion control, and high-speed networking. An emphasis will be placed on current issues, future directions, and research topics.

CISD 750 Database Management Systems (3 credits)

Theory and principles of databases and their management. Design, implementation, and traditional and nontraditional applications of database management systems.

CISD 760 Artificial Intelligence (3 credits)

Theory and practice of artificial intelligence and knowledge-based expert systems including issues in knowledge representation, search, heuristics, learning techniques, tools, languages, and programming techniques. Current issues, future directions, and research topics will be explored.

CISD 770 Software Engineering (3 credits)

Covers advanced topics in areas of current research interest in the development of software-intensive systems. Topics include metrics, requirements definition, development life cycles, software engineering processes, reuse, formal methods, verification and validation, and project management.

CISD 790 Special Topics in Computer Science (3 credits)

Covers advanced topics in areas of current research interest in computer science. May include topics in advanced computer architecture, artificial intelligence, distributed database management systems, advanced computer graphics, object-oriented technology, and parallel computation. Topics will vary depending on student and faculty interest. Depending on interest, several special topics courses may be offered concurrently.

CISD 792 Computer Graphics (3 credits)

This course will focus on algorithms and techniques that have emerged in the past several years. Topics include basic and advanced modeling and rendering methods, volume and scientific visualization techniques, visual programming languages and environments, and computer animation.

CISD 794 Knowledge Discovery in Databases (3 credits)

This course will study a number of emerging technical approaches to knowledge discovery in databases such as data clustering and summarization, algorithms for learning classification and characteristic rules, finding dependency networks, analyzing changes, detecting anomalies, and their applications. Current issues, future directions, and research topics will be explored.

CISD 800 Project in Theory and Principles of Programming (4 credits)

The mathematics of algorithms and the specification of design are the basis for the project to illustrate the benefits of structured models, quantitative documentation, and logical assertions for the interpretation and structure of computer programs. The projects include the use of modern languages to demonstrate the abstract structures necessary for application and system development.

CISD 830 Project in Operating Systems (4 credits)

Students pursue a research project or implementation on a current topic in operating systems. Implementation projects may involve constructing a portion of an operating system, simulating the behavior of key components, performance studies of existing systems, and creation of a concurrent programming environment to model parallel hardware and software. Research papers may investigate current topics such as open systems, distributed systems, massive parallelism, object-oriented operating systems, and real-time operating systems.

CISD 840 Project in Data Communications and Computer Networking (4 credits)

A research report, design, implementation, or simulation is the focus of a student project. Topics of current interest include routing, security, internetworking, and network or transport layer protocol design.

CISD 850 Project in Database Management Systems (4 credits)

Students pursue a research study on a current topic in database systems or complete a database-oriented development project. Some areas of current interest include object-oriented database systems, extended relational DBMS, deductive and logic-based expert database systems, federated or heterogeneous database systems, other high-performance parallel database systems, and advanced conceptual logic database modeling.

CISD 860 Project in Artificial Intelligence (4 credits)

Students pursue a research or development project in artificial intelligence. Topics of current interest are artificial life, learning technologies (including symbolic learning, neural networks, and genetic algorithms), intelligent agents, natural language processing, deep domain models in expert systems, vision, speech recognition, handwriting recognition, and parallel and distributed artificial intelligence.

CISD 870 Project in Software Engineering (4 credits)

A research report or implementation is the focus of a student project. Topics of current interest are metrics, formal methods, development life cycles, reuse, object-oriented analysis and design and software engineering for distributed systems.

CISD 890 Project in Special Topics in Computer Science (4 credits)

Students pursue a research study, project, or implementation related to the Special Topics in Computer Science course.

CISD 892 Project in Computer Graphics (4 credits)

Students pursue a research or implementation project on a current topic in computer graphics. Topics of interest include basic and advanced modeling and rendering methods, volume and scientific visualization techniques, visual programming languages and environments, computer animation, and virtual reality.

CISD 894 Project in Knowledge Discovery in Databases (4 credits)

Students pursue a research project or implementation on a current topic in knowledge discovery in databases. The research process for the project includes searching the literature, dissecting the existing methodologies for knowledge discovery in databases, and developing a new approach for knowledge discovery in databases.

CISD 910 Dissertation I (12 credits)

The student develops a framework within which doctoral research will be conducted and offers evidence of qualifications to pursue the research. Prerequisite: Satisfactory completion of all course work.

CISD 915 Dissertation II (12 credits)

Concepts and theories underlying the student's doctoral research are articulated; the problem is clearly stated; specific, measurable goals are specified; a thorough literature review is presented; the methods of conducting the research are delineated and a strategy to achieve the goal is given. Prerequisite: Dissertation I.

CISD 920 Continuing Dissertation (6 credits)

Students who have not completed the dissertation by the end of Dissertation II must register for Continuing Dissertation each term in order to receive faculty and administrative advice and support related to the dissertation. Prerequisite: Dissertation II.

CISD 1200 Directed Independent Study (3 credits or 4 credits)

Involves directed readings, research, and creative activities under the supervision of a faculty member. A contract for independent study must be prepared by the student, include an assignment timeline, and be approved by the mentoring faculty member and the program director. (See the section Independent-Study Basis, Directed Independent Study, or Taking a Course in Another Program)

Ph.D./Ed.D. Program in Computing Technology in Education

This program offers a course of study leading to the degree of doctor of philosophy (Ph.D.) or doctor of education (Ed.D.) in computing technology in education. It is offered in both cluster and institute formats, which combine on-campus and online instruction to provide professionals the opportunity to pursue graduate study while continuing to work in their current positions. This program addresses (1) the use of computing technologies to improve cognition; (2) the development, management, and evaluation of computing systems that support the educational process; and (3) the role of computing and other advanced technology in education and training. The program is especially well suited to educational administrators, college faculty members, directors of academic computing, teachers of all grades, district and building technology administrators, industry and armed forces trainers, and instructional system designers and developers. It provides technology-oriented professionals with the knowledge and ability to develop creative solutions to substantive real-world problems. Each student must complete eight courses, four projects, and a dissertation. A student may declare a degree preference (Ph.D. or Ed.D.) at any time during the program. The difference between these degrees is a name difference only. Many of the courses in the program have been approved for teacher certification in computer science (grades K–12) or recertification by Florida's Bureau of Teacher Certification. They may be taken as part of the degree program or independently. After students complete the course requirements they may apply for the educational specialist (Ed.S.) degree.

Program-Specific Admission Requirements (See Application for Admission for general requirements.)

This program is designed for the student with a master's degree in education, training and learning, instructional design, information systems, educational leadership, or a closely related field. The candidate must have a significant amount of experience using computer applications and the Internet. Alternatively, SCIS master's students may apply for early admission into the Ph.D./Ed.D. program. (For details, see sections on early admission under Master's Degree Programs.)