2000-2001

DEPAUL UNIVERSITY BULLETIN

SCHOOL OF COMPUTER SCIENCE,

TELECOMMUNICATIONS AND

INFORMATION SYSTEMS

GRADUATE PROGRAMS

MASTER OF SCIENCE IN COMPUTER SCIENCE

MASTER OF SCIENCE IN DISTRIBUTED SYSTEMS

MASTER OF SCIENCE IN E-COMMERCE TECHNOLOGY

MASTER OF SCIENCE IN HUMAN-COMPUTER INTERACTION

MASTER OF SCIENCE IN INFORMATION SYSTEMS

MASTER OF SCIENCE IN SOFTWARE ENGINEERING

MASTER OF SCIENCE IN TELECOMMUNICATIONS SYSTEMS

MASTER OF SCIENCE IN MANAGEMENT INFORMATION SYSTEMS/JOINT DEGREE

MASTER OF ARTS IN APPLIED TECHNOLOGY/JOINT DEGREE

DOCTOR OF PHILOSOPHY IN COMPUTER SCIENCE

To obtain a Bulletin for the Kellstadt Graduate School of Business call (312) 362-8870, for the College of Law call (312) 362-8870, or for Graduate Programs call (312) 362-5307.

DePaul University Bulletin (USPS = 154-2600), No. 5, July 1, 2000. Published monthly, March through July, five times per year by DePaul University, 1 East Jackson Boulevard, Chicago, Illinois, 60604. Periodicals postage paid at Chicago, Illinois. POSTMASTER: Send address changes to DePaul University Bulletin, 1 East Jackson Boulevard, Chicago, Illinois 60604.

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Editor: Anne Morley
The School of Computer Science, Telecommunications and Information Systems (CTI) offers courses at our Loop and Lincoln Park Campuses as well as at convenient suburban locations.

**LINCOLN PARK CAMPUS**
2320 North Kenmore Avenue
Chicago, Illinois 60614

**LOOP CAMPUS**
243 South Wabash
Chicago, Illinois 60604
312-362-8714
(full program of course offerings)

**LAKE FOREST CAMPUS**
150 Field Drive
Lake Forest, Illinois 60045

**NAPERVILLE CAMPUS**
150 West Warrenville Road
Naperville, Illinois 60566
(selected course offerings)

**O'HARE CAMPUS**
3166 River Road
Des Plaines, Illinois 60018
(selected course offerings)

**SCHAUMBURG CAMPUS**
Opening Autumn 2000-2001

Students may take courses at any of the locations. Currently all students must complete at least part of their degree program at the Loop Campus. However, as the University continues to expand the number and variety of courses at the suburban campuses, most students will be able to take increasing advantage of these locations.
ADMINISTRATION
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Dean
David P. Miller, Ph.D.
Associate Dean
Anne B. Morley
Assistant Dean

PHILOSOPHY

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Distributed Systems
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Human-Computer Interaction
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Telecommunication Systems
Management Information Systems
Applied Technology

Doctor of Philosophy
Computer Science

COURSES
PHILOSOPHY

DePaul University, founded on Judeo-Christian principles, continues to assert the relevance of these principles through higher education to modern men and women. The University expresses these principles especially by passing on the heritage of St. Vincent de Paul: individual perfection manifested through purposeful involvement with other persons, communities and institutions.

The School of Computer Science, Telecommunications and Information Systems assumes as its direct educational task to foster in its students those traditions of scholarship central to advanced studies and research. The programs for the master's and doctoral degrees are designed to develop in graduate students a broad and deep knowledge of their chosen discipline, the research methodology of the discipline and the development of those competencies necessary for their personal advancement in their scholarly, professional or creative careers.

Through the steady flow of its graduates into the community, the School strives to assist contemporary society to meet its need for educated individuals willing to be of service to others.

FACULTY

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<td>Charles C. Earl, Ph.D.</td>
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<td>Yale University</td>
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<td>Wilfredo Marrero, Ph.D.</td>
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<td>Carnegie Mellon University</td>
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<td>John C. McDonald, Ph.D.</td>
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<td>Daniel D. Mittleman, Ph.D.</td>
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<td>H. Ashley Morris, Ph.D.</td>
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<td>John D. Rogers, Ph.D.</td>
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PURPOSES

The School of Computer Science, Telecommunications and Information Systems (CTI) offers graduate level, professional education in these areas: artificial intelligence, collaborative technologies, computer science, computer graphics, computer vision, data analysis, database, data communications, data warehousing, distributed systems, e-commerce technology, human-computer interaction, information systems, management information systems, networking, project management, software engineering, systems foundation, systems development, telecommunication systems, and visual computing. Students choose from a broad collection of courses to develop, in depth, the research habits and practical skills needed for research and professional practice. The School's programs are designed to provide its graduates with the technical competence and the flexibility necessary to respond to both present and future opportunities in the computing professions.

FACILITIES

DePaul's Information Services (IS) Division houses a large network of computers and allows students access to a rich computing environment. Students have access to IBM PC laboratories and Macintosh laboratories at the Loop and Lincoln Park campuses. In addition, the
configuration includes several Sun SPARC centers for student use. There are numerous dial-up phone numbers available for off-campus work. DePaul’s suburban campuses in the Lake Forest, Naperville, O’Hare, Oak Forest, and Schaumburg areas also offer excellent student laboratory facilities. Permanent student Internet access accounts are available along with dial-in connections.

The School itself operates specialized laboratories for software research, multimedia networking, distributed systems, Java and high-performance computing, artificial intelligence research, American sign language, human-computer interaction, e-commerce technology, telecommunications, local area networks, and information systems. CTI’s incubator facility assists individuals who want to start a software business. Working with corporations, the facility’s personnel will help aspiring entrepreneurs develop business plans, research legal issues, manage projects and find marketing firms. These laboratories are typically populated with multiple Pentium-based Windows NT workstations and servers. Several large Sun Servers are also available for student and faculty use. Specialized equipment available for student use includes Cisco routers, LAN switches, and ATM switches as well as a Definity PBX system from Lucent Technologies. A communications research laboratory composed of multiple high-performance Sun workstations is currently under construction. The school also operates an IBM ES 9000/9221.

IS and School computers are connected through multiple Ethernets. The School’s computers and laboratories form several subnets using TCP/IP. A separate Ethernet network connects the IS IBM PC laboratories. DePaul is connected to the Internet through 8 T1 lines.

PROFESSIONAL DEVELOPMENT

The School of CTI established the Institute for Professional Development in 1985 to offer certificate programs designed to meet the needs of both individuals and businesses in the Chicagoland area. These non-degree offerings provide intensive training in a wide variety of areas, with each individual certificate program addressing a different set of theoretical concepts and practical skills. Emphasis is placed on gaining practical experience through a combination of lectures and demonstrations complemented by laboratory exercises and homework assignments.

A team of instructors teaches each certificate program. Instructors include full-time faculty with consulting experience and part-time instructors from industry. Each program requires a substantial commitment of time, as classes meet two nights per week and in the morning on half of the Saturdays during the program.

For application and registration information pertaining to the certificate programs offered by the Institute for Professional Development, please call the Institute office at (312)362-6282.
ADMISSION PROCEDURES

Procedures for admission to the School of CTI involve submission of a completed application form and supporting credentials, payment of admission fee, observance of deadlines and receipt of the Dean's admission letter. Applications may be submitted online at www.cs.depaul.edu.

Application Form: Applicants may obtain a graduate application form by mailing a request to the School of CTI Graduate Office, DePaul University, 243 South Wabash, Chicago, Illinois, 60604, by filling out a form at our website at http://www.cs.depaul.edu, or by calling (312) 362-8381. The applicant should include his/her proposed program of study in the request.

Application deadlines for MS applicants are:
- August 1 for Autumn Quarter
- November 15 for Winter Quarter
- March 1 for Spring Quarter
- May 1 for Summer Quarter

Students educated outside the United States must submit an application and all supporting credentials no later than:
- June 1 for Autumn Quarter
- October 1 for Winter Quarter
- January 1 for Spring Quarter
- April 1 for Summer Quarter

Supporting Credentials: Official transcripts of the applicant's academic records at all universities, colleges and junior colleges attended are required. Please direct the registrar(s) to mail these official transcripts directly to the School of CTI Office, DePaul University. The applicant is advised to make his/her request as early as possible, because there is frequently a delay in the forwarding of transcripts. A DePaul senior applying to the Graduate School should request the registrar to forward an official transcript to the School of CTI office.

NOTE: Programs may require additional supporting credentials. Please consult the specific programs listed in this bulletin to determine what additional materials are required for admission to the specific course of graduate study.

Admission Fee: A check or money order payable to DePaul University in the amount of $25.00 must accompany the completed application form. Any application form received without the fee will be returned unprocessed. The fee is nonrefundable.

Dean's Admission Letter: The Dean will notify the applicant by letter of his/her admission status. It is the policy not to review, evaluate or act upon any application for admission without having the completed application form, all the supporting credentials, and the application fee. The review process is done on a rolling basis.

INTERNATIONAL STUDENT ADMISSION

The admission requirements stated above also apply to international students. Applicants educated outside of the United States must meet academic requirements and demonstrate English proficiency with a TOEFL score of 550 or greater (580 or greater for Ph.D. applicants). Those requesting student visas (I-20) must demonstrate adequate financial support. The letter of admission and the visa form I-20 are issued only after admission.

International applicants are strongly urged to apply as early as possible. There are usually long delays in the forwarding of all supporting credentials.
READMISSION PROCEDURES

Applicants who have been admitted to the School, but do not enroll in the University within one year of the date on their letter of admission, must complete an application for readmission. There is a $5.00 service fee for processing a readmission.

Former CTI students must also apply for readmission if they were previously enrolled in a graduate program in the School of CTI, but have not been in attendance for a period of one calendar year. If more than four calendar years have elapsed since the student has been in attendance, the student must submit a new application for admission, including the $25.00 application fee. An official copy of transcripts recording scholastic work completed since the last enrollment at DePaul University must be submitted. As a general rule, students are held to the degree requirements that are in effect at the time of readmission.

RECLASSIFICATION PROCEDURES

Once a student fulfills the conditions of admission, the student must file a Change of Concentration/Status application with the School office so his/her status can be updated to full degree-seeking status. A student must also file a Change of Concentration/Status application if he/she decides to change his/her major. As a general rule, students are held to the degree requirements that are in effect at the time the student changes his/her major.

DEPAUL SENIORS

Seniors in any of the undergraduate colleges or schools of DePaul University are eligible to apply for admission to the School of CTI while completing their undergraduate program.

ADMISSION CLASSIFICATIONS

Applicants are admitted to the School of CTI on the basis of their ability to complete programs of study and research prescribed for the master's and doctoral degrees. Specifically, admission qualifications are measured by academic criteria. In accord with these criteria, applicants are admitted in one of three major categories: degree-seeking, non-degree-seeking, and student-at-large.

Degree-Seeking Students

Applicants are classified as degree-seeking students in either of two ways: conditional or full. A conditionally admitted applicant is eligible for reclassification to full degree-seeking status when the Prerequisite Phase is satisfied by coursework or substitution. (See Reclassification Procedures above.) The minimum requirements for conditional degree-seeking status are: possession of a bachelor's degree conferred by a regionally accredited institution, scholastic achievement in undergraduate studies indicating a capacity to pursue successfully a specific program of graduate study, submission of all required supporting credentials to the School office, and conditional approval by the program director of the applicant's proposed course of graduate study. The minimum requirements for full degree-seeking status include the requirements stated for conditional degree-seeking status, in addition to more specific and selective criteria for admission to specific programs.
Non-Degree Seeking Students

At the Dean's discretion, applicants who do not wish to pursue an advanced degree may be admitted. Non-degree-seeking students may, at some future date, apply for reclassification to degree-seeking status. The minimum requirements for this status are possession of a bachelor's degree conferred by a regionally accredited institution, scholastic achievement in undergraduate studies indicating a capacity to pursue successfully graduate course work, submission to the School office of all required supporting credentials, a letter of intent addressed to the Dean, and approval by the Dean. Students seeking non-degree status will also have to submit a completed application, including a check or money order made payable to DePaul University in the amount of $25.00 for the application fee. The application fee is non-refundable.

When students with non-degree seeking status file for reclassification to degree-seeking status, the program director may recommend, in writing, to the Dean that a maximum of three courses (12 quarter hours) that were completed by the student under the non-degree-seeking status be counted toward fulfillment of the advanced degree requirements.

Student-at-Large

The School of CTI may admit as a student-at-large a graduate student currently enrolled in a graduate program in another accredited institution upon the recommendation, in writing, of the student's own graduate Dean. A student-at-large must submit an application for admission to the School office (including the $25.00 application fee). The only supporting credential required is a letter from the Dean of the graduate school where the student is in good standing. This letter should state in general terms the course or courses the student is authorized to take. Under no circumstances does this classification constitute admission to a degree program at DePaul University.

Graduate Credit Transfer

Credit transfer in degree programs leading to the master's or doctoral degree is ordinarily not allowed. However, the Dean may authorize an exception to this policy when, in the judgment of the Dean and the program director, the circumstances justify the exception.

Doctoral Program Admission Requirements

The School of CTI offers a Doctor of Philosophy in Computer Science. The Doctor of Philosophy is the highest academic degree offered by DePaul University. This degree shows that the recipient has attained great proficiency in several broad areas of learning and has demonstrated capability to explore and advance a particular field of knowledge through independent research. In order to be considered for admission to the doctoral program, students must:

- Hold a master's degree in Computer Science or an allied field or hold a Bachelor of Science degree with exceptional promise for completion of the Ph.D.
- Submit three letters of recommendation.
- Submit a written statement describing their accomplishments, goals and interests.
- Submit a completed application form.
- Submit an official score report of the Graduate Record Examination (GRE).
- Applicants educated outside of the United States must demonstrate English proficiency with a TOEFL score of 580 or greater.

A Ph.D. Admissions Committee determines which applicants will be admitted to the program. Because the School may only admit a limited number of students to the program, meeting the admission standards does not guarantee acceptance. Detailed program specifications can be found in the Ph.D. program section.
MASTER OF SCIENCE IN COMPUTER SCIENCE

The Master of Science in Computer Science is the most technical of CTI's master's programs. The courses in the Prerequisite Phase and Core Knowledge Phase focus on the foundations and fundamentals of programming languages, and the theoretical underpinnings of computer science. The Advanced Phase gives students a great deal of flexibility, allowing them to concentrate in a wide range of subareas of computer science or other areas of CTI. This degree is appropriate for students who wish to pursue a technical career in any of a number of areas of computer science, or for students who may wish to pursue a Ph.D. degree in the future.

The program follows a three-phase sequence, with each phase preparing the student for the subsequent phase. The master's degree program consists of:

- Prerequisite Phase
- Core Knowledge Phase
- Advanced Phase

Upon acceptance into the master's degree program, the student will meet with his/her faculty advisor to discuss required courses for the Prerequisite Phase. The Prerequisite Phase ensures that all students enter graduate courses with an equivalent background. While completing this phase, a student is considered a conditionally admitted master's student. In the Core Knowledge phase, a student will follow a sequence of courses to acquire an understanding of the technological and theoretical foundations for this degree. In the Advanced Phase of the program, the fundamental information learned previously allows a student to study advanced topics. This phase adds depth to the work completed in the Core Knowledge Phase. Individual interests and needs are also addressed through a series of elective courses chosen in consultation with the student's faculty advisor.

GRADE AND GPA REQUIREMENTS

Grades: Students must receive a grade of B- or better in each prerequisite course and a C- or better in all other courses.

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.75 and a designation of distinction on the core examinations will graduate with distinction.

PREREQUISITE PHASE

The courses in the Prerequisite Phase for the MS in Computer Science are:

- CSC 215 Introduction to Structured Programming using C++ and
- CSC 310 Principles of Computer Science I or
- CSC 225 C++ for Programmers

(CSC 225 is equivalent to both CSC 215 and CSC 310. Only students with experience in programming languages should take CSC 225.)

- CSC 323 Data Analysis and Statistical Software I
- CSC 343 Introduction to Operating Systems
- CSC 345 Computer Architecture
- CSC 415 Foundations of Computer Science I
- CSC 416 Foundations of Computer Science II
- CSC 417 Foundations of Computer Science III

By taking these courses and receiving a grade of a B- or better in each, the student will have completed the requirements of the Prerequisite Phase. All or part of the Prerequisite Phase may be waived if a student has the equivalent academic background. Alternatively, students with practical experience may complete a Graduate Assessment Examination (GAE) to show compe-

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tency in a prerequisite. All students are blocked from enrolling in Core Knowledge Phase courses prior to completing their prerequisites. The student must submit a Change of Status request when the Prerequisite Phase is completed to inform the Student Services office that the block can be removed. The form must be submitted two weeks before the student intends to register for graduate-level classes. The student will then be considered a fully admitted student and may pass to the Core Knowledge Phase of the program.

**CORE KNOWLEDGE PHASE**

*Core Knowledge Courses.* Fully admitted students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses. The Core Knowledge Phase courses for the MS in Computer Science are:

- **CSC 447** Concepts of Programming Languages
- **CSC 491** Design and Analysis of Algorithms
- **SE 455** Software Development Methods

*Core Knowledge Examination.* These examinations cover the subject matter of the Core Knowledge Phase courses. Students have the option of taking one, two or three core exams at one time after completion of the applicable course or courses. Possible grades on the Core Examinations are Pass with Distinction, Pass, and Fail. Students are allowed at most two attempts at each exam. Two failures on one exam result in dismissal from the graduate program.

**ADVANCED PHASE**

The Advanced Phase consists of ten courses. At least four of these courses must be designated as Level II courses. The ten courses are as follows:

- Four courses from a Primary Concentration (at least two of which are designated as Level II courses).
- Three courses from a Secondary Concentration.
  - The Primary and Secondary Concentrations are chosen form the list below. If the same course is listed in two concentrations, it may only count toward fulfilling the course requirements of one concentration.
- Three elective courses.
  - Students must choose three graduate level elective courses from the School of CTE. Elective courses are in the range of 420-699. Credit for courses taken outside of the school will be given only if approved by a faculty advisor. Courses suggested for any Prerequisite Phase do not count for elective credit. Any course required for the student's concentration but taken as part of the requirements of another degree earned by the student may be waived, but cannot be used for elective credit.

*Artificial Intelligence Concentration* is the study of computational models of intelligence. AI researchers split roughly into two camps: those concerned with forming models of human cognitive behavior that are computational, and those who wish to make computers perform tasks requiring intelligence for humans to perform, without necessarily simulating human mechanisms. The techniques used in both camps may be either symbolic in nature or more directly modeled on neural computation. Regardless of the approach, researchers also develop languages and tools to support the development of the complex software systems realizing these models. The AI concentration covers all these approaches, with a particular emphasis on applying the languages, tools and techniques of AI to such areas as planning, natural language processing, vision, knowledge representation, learning, neural nets, cognitive modeling, and expert systems.
LEVEL I
CSC 456 Foundations of Intelligent Databases
CSC 457 Expert Systems
CSC 458 Symbolic Programming
CSC 480 Foundations of Artificial Intelligence

LEVEL II
CSC 578 Neural Networks
CSC 580 Artificial Intelligence Programming
CSC 583 Natural Language Processing
CSC 594 Topics in Artificial Intelligence
DS 599 Intelligent Information Retrieval

Computer Graphics Concentration encompasses synthetic imaging, animation, computer-aided design, visualization, and the technology of interactive techniques. Synthetic imaging includes such techniques as raytracing, while animation covers both physically-based and character-based motion. Computer-aided design helps industry to visualize entities (buildings, airplanes) that do not yet exist while visualization helps people to comprehend large datasets. A concentration in Computer Graphics prepares students for work in the dynamic and rapidly changing areas of industry involving computer graphics, such as animation, CAD/CAM, graphical user interface development, and gaming. Computer Graphics has close ties with computer vision, human-computer interaction, and distributed computing.

LEVEL I
CSC 438 Survey of Computer Animation
CSC 469 Computer Graphics I
CSC 470 Survey of Computer Graphics

LEVEL II
CSC 536 Modeling for Computer Aided Design
CSC 539 Computer Graphics II
CSC 570 Visualization
CSC 574 Computer Games
CSC 575 Advanced Graphics Development
CSC 595 Topics in Graphics

Computer Vision Concentration deals with the study of data structures, algorithms, and hardware for processing visual information. It includes traditional areas such as robot vision, signal and image processing, and pattern recognition, and newer areas such as graphical user interfaces and scientific visualization. Completion of the Computer Vision concentration can lead to a career in the development of vision systems for robotic devices, working with barcode or document scanners, or analyzing X-rays and other medical images. Students interested in the computer vision concentration should also consider taking courses in related areas such as computer graphics, graphical user interfaces, and distributed computing.

LEVEL I
CSC 481 Pattern Recognition and Image Processing
CSC 498 Digital Signal Processing

LEVEL II
CSC 538 Vision Systems
CSC 584 Computer Vision
CSC 592 Topics in Computer Vision and Pattern Recognition
Data Analysis Concentration is the study of how to describe and model numerical data, how to encode these models using software tools, and how to interpret and report the results. The core courses provide students with the fundamentals of both computer science and data analysis. Students complete their program by choosing from a wide variety of related topics including artificial intelligence, database, data communications, formal methods, genetic algorithms, graphics, machine learning, multimedia, neural networks, numerical analysis, operations research, pattern recognition, queuing theory, simulation, software measurement, software reliability, and visual computing. The program is especially suited to students with an interest in quantitative topics with an applied rather than theoretical emphasis complemented with a firm grounding in computing.

LEVEL I
CSC 423 Data Analysis and Regression
CSC 425 Categorical Data Analysis
CSC 428 Data Analysis for Experimenters
SE 468 Software Measurement

LEVEL II
SE 467 Software Reliability
CSC 523 Multivariate Data Analysis
CSC 524 Advanced Data Analysis
CSC 598 Topics in Data Analysis

Database Systems Concentration studies data modeling, database management systems (DBMS), and database application development. The curriculum includes three required database courses focusing on relational database technology, database design, and database programming. Students may choose from advanced database courses covering distributed and client/server databases, object-oriented databases, and many other advanced database technologies and applications. This concentration would be appropriate for anyone seeking a career in database administration, database design, database application development, or DBMS development. The concentration also provides an excellent foundation for advanced graduate study.

LEVEL I
CSC 449 Database Systems
CSC 451 Database Design
CSC 452 Database Programming
CSC 453 Client/Server Database Development

LEVEL II
CSC 549 Advanced Database Systems
CSC 550 Object-Oriented Databases
CSC 551 Distributed Database Systems
CSC 589 Topics in Databases

Data Communications Concentration is the study of traditional computer systems and software development. Students choose from a variety of courses in data communications protocols and networking. This concentration would be appropriate for anyone seeking a career in network software development, integration of network projects into existing system applications, or other work in a traditional computer center that uses networks.
LEVEL I
TDC 462 Data Communications
TDC 463 Computer Networks and Data Systems
TDC 561 Network Programming

LEVEL II
TDC 432 Computer and Information Systems Modeling
TDC 489 Queuing Theory with Computer Applications
TDC 513 Client/Server Technologies
TDC 562 Computer Communications Network Design and Analysis
TDC 563 Protocols and Techniques for Data Networks
TDC 564 Local Area Networks
TDC 566 Integrated Services Digital Networks
TDC 568 Network Management

Systems Foundations Concentration is for students who desire current, advanced broad-based technical work in computing technology. This is a flexible concentration that may be customized to the student's particular needs and interests. This concentration also provides the foundation necessary to pursue a Ph.D.

LEVEL I
CSC 426 Values and Computer Technology
CSC 434 Object-Oriented Programming
CSC 444 Automata Theory and Formal Grammars
CSC 448 Compiler Design

LEVEL II
CSC 503 Parallel Algorithms
CSC 504 Parallel Processing
CSC 535 Formal Semantics
CSC 544 Advanced Theoretical Computer Science
CSC 545 Advanced Computer Organisation
CSC 546 Advanced Operating Systems
CSC 547 Advanced Topics in Programming Languages
CSC 548 Advanced Compiler Design
CSC 599 Topics in Computer Science

The following Concentrations from other divisions of CTI may be selected for a secondary concentration only.

Distributed Systems Concentration

LEVEL I
DS 420 Foundations of Distributed Systems

LEVEL II
SE 590 Distributed Software Development
DS 513 Client/Server Technologies
DS 553 Design and Strategies for Internet Commerce
DS 520 Distributed Systems Practicum
DS 594 Distributed Systems Project
DS 599 Topics in Distributed Systems
E-Commerce Technology Concentration

LEVEL I
ECT 555    Design and Strategies for Internet Commerce

LEVEL II
ECT 441    Usability Issues for E-Commerce
ECT 580    Advanced Web Information Systems
ECT 581    Extranet Systems
ECT 582    Secure Commerce

Human-Computer Interaction Concentration

LEVEL I
HCI 400    Analysis and Design for HCI
HCI 440    Introduction to Human-Computer Interaction
HCI 460    Evaluating HCI

LEVEL II
HCI 422    Multimedia
Any 500-level HCI course

Information Systems Concentration

LEVEL I
IS 421    Information Systems Analysis and Design
IS 422    Information Systems Design
IS 483    Information Systems Management

LEVEL II
IS 512    Groupware and Virtual Collaboration
IS 553    Advanced Topics for Systems Development
ECT 555    Design and Strategies for Internet Commerce
IS 556    Project Management
IS 560    Enterprise Resource Planning
IS 574    Decision Support Systems and Executive Information Systems
IS 577    Information Technology Policy and Strategies

Software Engineering Concentration

LEVEL I
SE 430    Object-Oriented Modeling
SE 431    Formal Software Specifications and Development I
SE 450    Object-Oriented Software Development
SE 452    Object-Oriented Enterprise Application Development
SE 480    Software Architecture

LEVEL II
SE 531    Formal Software Specifications and Development II
SE 533    Software Validation and Verification
SE 540    Software Development for Mobile and Embedded Systems
SE 550    Distributed Software Development
SE 552    Concurrent Software Development
SE 560    Structured Document Interchange and Processing
Three elective courses must be completed. When choosing electives, keep in mind that four Level II courses (at least two of which will have been completed in the primary concentration) must be completed in order to graduate. See elective restrictions below.

**Elective Course Restrictions**

Elective courses are in the range of 420-699 and must be from the school of CIT. Credit for courses taken outside of the school will only be given if approved by a faculty advisor. Courses suggested for any Prerequisite Phase in any concentration do not count for elective credit. Any course required for the student’s concentration but taken as part of the requirements of another degree earned by the student may be waived, but cannot be used for elective credit.

**Personalized Concentration**

Students with superior results on the Core Knowledge Phase examination may be allowed to personalize their Advanced Phase requirements. After planning their personalized concentration with their advisor, they must submit the plan to the CIT associate dean for approval. Permission for the personalized concentration must be obtained prior to completion of most of the concentration courses.

**Master’s Research Option**

Students interested in a more in-depth study of a particular area in their concentration can choose to work with a faculty member (not necessarily their academic advisor) on a research project. This option can be satisfied by taking the course CSC 696 (Master’s Project) at least twice, each time for four credits. The research option replaces one elective course and one Level II course in the student’s primary area of concentration. Students who choose this option must successfully complete the core exams prior to their first enrollment in CSC 696. The research project must represent an original contribution to the area and may include system development, empirical studies, or theoretical work. The scope and the details of the research project will be determined by the research supervisor and must be approved by the student’s academic advisor. At the end of the two quarters, the student must submit a technical report detailing the results of the research project. This report must be approved by the student’s research supervisor and the faculty advisor, after which it will be made available to the public as a CIT Departmental Technical Report. A special designation will be included in the transcripts and diplomas of students who choose and successfully complete the Master’s Research Option.
MASTERS OF SCIENCE IN DISTRIBUTED SYSTEMS

The Master of Science in Distributed Systems degree is a synthesis of the traditional disciplines of computer science, software engineering, and telecommunications with modern technologies that incorporate the use of distributed platforms in their application. The rigorous curriculum includes its Core Phase, software development in languages such as Java, the study of protocols such as DCOM/ActiveX and CORBA, the study of architectures such as client/server, and the study of traditional network routing and protocols. In the Advanced Phase, students study network and concurrent programming, databases, and distributed software, using these to develop sophisticated applications. Graduates of this program will be prepared to lead innovation in the new wave of Intranet and Web applications.

The program follows a three-phase sequence, with each phase preparing the student for the subsequent phase. The master's degree program consists of:

- Prerequisite Phase
- Core Knowledge Phase
- Advanced Phase

Upon acceptance into the master's degree program, the student will meet with his/her faculty advisor to discuss required courses for the Prerequisite Phase. The Prerequisite Phase ensures that all students enter graduate courses with an equivalent background. While completing this phase, a student is considered conditionally admitted to the master's student. In the Core Knowledge phase, a student will follow a sequence of courses to acquire an understanding of the technological and theoretical foundations for this degree. In the Advanced Phase of the program, the fundamental information learned previously allows a student to study advanced topics. This phase adds depth to the work completed in the Core Knowledge Phase. Individual interests and needs are also addressed through a series of elective courses chosen in consultation with the student's faculty advisor.

GRADE AND GPA REQUIREMENTS

Grades: Students must receive a grade of B- or better in each prerequisite course and a C- or better in all other courses.

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.75 and a designation of distinction on the core examinations will graduate with distinction.

PREREQUISITE PHASE

The courses in the Prerequisite Phase for the MS in Distributed Systems are:

- CSC 215 Introduction to Structured Programming using C++ and
- CSC 310 Principles of Computer Science I or
- CSC 225 C++ for Programmers

(CSC 225 is equivalent to both CSC 215 and CSC 310. Only students with experience in programming languages should take this course.)

- CSC 314 Introduction to Java
- CSC 323 Data Analysis and Statistical Software I
- CSC 343 Introduction to Operating Systems
- CSC 345 Computer Architecture
- CSC 415 Foundations of Computer Science I
- CSC 416 Foundations of Computer Science II

By taking these courses and receiving a grade of a B- or better in each, the student will have completed the requirements of the Prerequisite Phase. All or part of the Prerequisite Phase may be waived if a student has the equivalent academic background. Alternatively, students with practical experience may complete a Graduate Assessment Examination (GAE) to show
competency in a prerequisite. All students are blocked from enrolling in Core Knowledge Phase courses prior to completing their prerequisites. The student must submit a Change of Status request when the Prerequisite Phase is completed to inform the Student Services office that the block can be removed. The form must be submitted two weeks before the student intends to register for graduate level classes. The student will then be considered a fully admitted student, and may pass to the Core Knowledge Phase of the program.

**CORE KNOWLEDGE PHASE**

**Core Knowledge Courses.** Fully admitted students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses. The Core Knowledge Phase courses for the MS in Distributed Systems are:

- **DS 420** Foundations of Distributed Systems
- **SE 450** Object-Oriented Software Development
- **TDC 463** Computer Networks

**Core Knowledge Examination.** These examinations cover the subject matter of the Core Knowledge Phase courses. Students have the option of taking one, two, or three core exams at one time after completion of the applicable course or courses. Possible grades on the Core Examinations are Pass with Distinction, Pass, and Fail. Students are allowed at most two attempts at each exam. Two failures on one exam result in dismissal from the graduate program.

**ADVANCED PHASE**

A student must complete 40 credits (10 courses) in the Advanced Phase to earn the MS in Distributed Systems. Students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses prior to passing the Core Knowledge Examination. Students must complete the following five courses:

- **CSC 449** Database Technologies
- **DS 421** Distributed Systems Programming
- **DS 520** Distributed Systems Frameworks
- **SE 550** Distributed Software Development
- **TDC 561** Network Programming

Students must also complete three classes chosen from the following list:

- **CSC 447** Concepts of Programming Languages
- **CSC 491** Design and Analysis of Algorithms
- **CSC 545** Advanced Computer Organization
- **CSC 546** Operating System Design
- **CSC 551** Distributed Database Systems
- **DS 431** Cluster Computing
- **DS 513** Client/Server Technologies
- **DS 594** Distributed Systems Project
- **HCI 440** Introduction to Human-Computer Interaction
- **IS 512** Groupware and Virtual Collaboration
- **ECT 555** Design and Strategies for Internet Commerce
- **TDC 462** Data Communications

Two elective courses must also be completed. See elective restrictions below.

**Elective Course Restrictions** Elective courses are in the range of 420-699 and must be from the school of CIT. Credit for courses taken outside of the school will only be given if approved by a faculty advisor. Courses suggested for any Prerequisite Phase in any concentration do not count for elective credit. Any course required for the student's concentration but taken as part of the requirements of another degree earned by the student may be waived, but cannot be used for elective credit.
MASTER OF SCIENCE IN E-COMMERCE TECHNOLOGY

The Master of Science in E-Commerce Technology is directed toward those who desire to work in the rapidly expanding field of e-commerce application development. With the explosive growth of the Internet, industries are increasingly employing Internet and related electronic commerce technologies to support consumer-oriented Internet retailing, business-to-business trading, and electronic marketplaces. Students in this program will become conversant in a broad and ever-changing mix of technologies, programming languages and tools. Practicums, team projects, and work for real clients provide an authentic environment for learning, which prepares graduates to lead e-commerce application development in large organizations or consulting firms, or establish their own consulting practices in this rapidly growing field.

The program follows a three-phase sequence, with each phase preparing the student for the subsequent phase. The master's degree program consists of:

- Prerequisite Phase
- Core Knowledge Phase
- Advanced Phase

Upon acceptance into the master's degree program, the student will meet with his/her faculty advisor to discuss required courses for the Prerequisite Phase. The Prerequisite Phase ensures that all students enter graduate courses with an equivalent background. While completing this phase, a student is considered a conditionally admitted master's student. In the Core Knowledge Phase, a student will follow a sequence of courses to acquire an understanding of the technological and theoretical foundations for this degree. In the Advanced Phase of the program, the fundamental information learned previously allows a student to study advanced topics. This phase adds depth to the work completed in the Core Knowledge Phase. Individual interests and needs are also addressed through a series of elective courses chosen in consultation with the student's faculty advisor.

GRADE AND GPA REQUIREMENTS

Grades: Students must receive a grade of B- or better in each prerequisite course and a C- or better in all other courses.

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.75 and a designation of distinction on the core examinations will graduate with distinction.

PREREQUISITE PHASE

CSC 225  C++ for Programmers (or CSC 215 and CSC 310)
ECT 270  Client Side Web Application Development
CSC 314  Programming in Java
CSC 315  Analysis and Design Technique
CSC 323  Data Analysis and Statistical Software I
ECT 410  Web Application Development with Scripting

By taking these courses and receiving a grade of B- or better in each, the student will have completed the requirements of the Prerequisite Phase. All or part of the Prerequisite Phase may be waived if a student has the equivalent academic background. Alternatively, students with practical experience may complete a Graduate Assessment Examination (GAE) to show competency in a prerequisite. All students are blocked from enrolling in Core Knowledge Phase courses prior to completing their prerequisites. The student must submit a Change of Status request when the Prerequisite Phase is completed to inform the Student Services office that the block can be
removal. The form must be submitted two weeks before the student intends to register for graduate level classes. The student will then be considered a fully admitted student, and may pass to the Core Knowledge Phase of the program.

**Core Knowledge Phase**

**Core Knowledge Courses.** Fully admitted students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses. The Core Knowledge Phase courses for the MS in E-Commerce Technology are:

ECT 555  Design and Strategies for Internet Commerce
CSC 449  Database Systems
DS 420  Foundations of Distributed Systems

**Core Knowledge Examination.** These examinations cover the subject matter of the Core Knowledge Phase courses. Students have the option of taking one, two or three core exams at one time after completion of the applicable course or courses. Possible grades on the Core Examinations are Pass with Distinction, Pass, and Fail. Students are allowed at most two attempts at each exam. Two failures on one exam result in dismissal from the graduate program.

**Advanced Phase**

The Advanced Phase consists of ten courses. The student should take six required courses, three electives from a list of relevant courses, and one open elective. The capstone course, ECT 589, should be taken near the completion of the program.

**Required:**

ECT 441  Usability Issues for E-Commerce
ECT 580  Advanced Web Information Systems
ECT 581  Extranet Systems
ECT 582  Secure E-Commerce
DS 520  Distributed Systems Practicum
ECT 589  E-Commerce Management

**Three of the following:**

ECT 423  Internet Multimedia
ECT 583  Advanced Scripting Technologies
ECT 584  Web Data Mining for Business Intelligence
ECT 585  Legal Aspects of E-Commerce
ECT 586  Customer Relationship Management Technologies
ECT 590  Topics in E-Commerce Technology
ECT 690  Research Seminar
ECT 696  Master’s Project
ECT 698  Master’s Thesis
HCI 460  Evaluating Human-Computer Interaction
HCI 540  User Interface Implementation
DS 513  Client/Server Technologies
DS 594  Distributed Systems Project
DS 599  Topics in Distributed Systems
CSC 451  Database Design
CSC 452  Database Programming
CSC 453  Client/Server Database Application Development
TDC 463  Computer Networks and Data Systems
TDC 564  Local Area Networks
IS 450  Technology Organization Transformation
IS 512  Groupware and Virtual Collaboration
IS 540  Global Information Technology
IS 549  Data Warehousing and Data Mining
IS 556  Project Management
IS 560  Enterprise Resource Planning
IS 574  Decision Support Systems and Executive Information Systems
IS 575  Information Retrieval
IS 578  Information Technology Consulting
SE 452  Object-Oriented Enterprise Application Development

One open elective (CTI course in the range of 420-699).

**Elective Course Restrictions**

Elective courses are in the range of 420-699 and must be from the school of CTI. Credit for courses taken outside of the school will only be given if approved by a faculty advisor. Courses suggested for any Prerequisite Phase in any concentration do not count for elective credit. Any course required for the student’s concentration but taken as part of the requirements of another degree earned by the student may be waived, but cannot be used for elective credit.
MASTER OF SCIENCE IN HUMAN-COMPUTER INTERACTION

Human-Computer Interaction (HCI) is a rapidly growing discipline. HCI practitioners are involved in the design, implementation, and evaluation of computer interfaces that are accessible and easy for people to use. This new degree integrates courses in computer science, graphic design, psychology, and human-computer interaction to provide a broad understanding of the discipline.

The program has five phases, with each phase preparing the student for the subsequent phase. The master’s degree program consists of:

- Prerequisite Courses
- Fundamentals Courses
- Core Courses
- Advanced Phase
- Capstone Course

Upon acceptance into the master’s degree program, the student will meet with a faculty advisor to discuss prerequisite courses. The Prerequisite courses are intended to ensure that all students enter graduate courses with an equivalent background. The Fundamental courses offer knowledge in the multiple disciplines that contribute to HCI. Students in the Core courses acquire an understanding of the technological and theoretical foundations, and the Advanced Phase provides students the opportunity to study specialized topics in greater depth. This phase adds depth to the work completed in the previous phases. The degree culminates in the experience of the Capstone Course where students take a real-life problem from design through implementation and usability testing.

GRADE AND GPA REQUIREMENTS

Grades: Students must receive a grade of B- or better in each prerequisite course and a C- or better in all other courses.

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.75 and a designation of distinction on the core examinations will graduate with distinction.

PREREQUISITE PHASE

The courses in the Prerequisite Phase for the MS in Human-Computer Interaction are:

- ART 105 Foundation Design or
- HCI 402 Foundations of Digital Design
- CSC 150 Introduction to Computer Systems and Programming
- CSC 240 Personal Computing for Programmers
- CSC 255 Information Structures and Representations
- CSC 323 Data Analysis and Statistical Software I
- PSY 105 Introductory Psychology I

By taking these courses and receiving a grade of a B- or better in each, the student will have completed the requirements of the Prerequisite Phase. All or part of the Prerequisite Phase may be waived if a student has the equivalent academic background. Alternatively, students with practical experience may complete a Graduate Assessment Examination (GAE) to show competency in a computer science prerequisite. All students are blocked from enrolling in Fundamental and Core courses prior to completing their prerequisites. The student must submit a Change of Status request when the Prerequisite Phase is completed to inform the Student Services offices that the block can be removed. The student will then be considered a fully admitted student, and may pass to the Fundamental and Core courses of the program.

FUNDAMENTALS COURSES

Students should complete their Prerequisite courses before beginning the Fundamental courses. However, while completing the Prerequisite courses, students may take Fundamental courses with consent of their faculty advisor. The Fundamental courses for the MS in Human-Computer Interaction are:
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ART 460</td>
<td>Graphic Design I or</td>
</tr>
<tr>
<td>HCI 470</td>
<td>Digital Page Formatting I</td>
</tr>
<tr>
<td>ART 461</td>
<td>Graphic Design II or</td>
</tr>
<tr>
<td>HCI 471</td>
<td>Digital Page Formatting II</td>
</tr>
<tr>
<td>HCI 400</td>
<td>Analysis and Design for HCI</td>
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<tr>
<td>PSY 680</td>
<td>Industrial and Organizational Psychology or</td>
</tr>
<tr>
<td>IS 450</td>
<td>Technological Organization Transformation</td>
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<tr>
<td>PSY 443</td>
<td>Psychology of Human Performance or</td>
</tr>
<tr>
<td>HCI 450</td>
<td>Usability in Computing Systems</td>
</tr>
</tbody>
</table>

**Core Courses**

Students must complete all Prerequisite courses and should complete all Fundamental courses before taking Core courses. The Core courses are:

- HCI 440  Introduction to Human-Computer Interaction
- HCI 430  Prototyping for Human-Computer Interaction
- HCI 460  Evaluating Human-Computer Interaction

**Advanced Phase Courses**

Students must complete four of the following courses to be taken from at least two categories:

**Design**

- ART 405  Advanced Color Design
- ART 462  Publication Design
- HCI 422  Multimedia
- HCI 441  Usability Issues for E-Commerce
- HCI 511  Designing for Disabilities
- HCI 512  Designing for Visualization
- HCI 513  Design and Strategies for Internet Commerce
- HCI 560  Information Technology Training and User Support
- HCI 590  Topics in Human-Computer Interaction

**Computer Science**

- CSC 469  Computer Graphics I
- CSC 470  Survey of Computer Graphics
- CSC 539  Computer Graphics II
- CSC 570  Visualization
- HCI 432  User-Centered Interactive Web Development
- HCI 540  User Interface Implementation I

**Evaluation**

- CSC 423  Data Analysis and Regression
- CSC 424  Advanced Data Analysis
- CSC 428  Data Analysis for Experimenters
- PSY 402  Perceptual Processes
- PSY 404  Learning and Cognitive Processes
- PSY 645  Organization Development
- PSY 646  Needs Analysis
- PSY 647  Organizational Consulting: Diagnosis
- PSY 649  Testing: Measurement, Application and Legal Considerations
- PSY 650  Creativity and Decision Making

**Capstone Course**

- HCI 594  Human-Computer Interaction Capstone
MASTER OF SCIENCE IN INFORMATION SYSTEMS

The master's degree program in Information Systems provides advanced training in systems development methodology and the use of information technology in enabling organizational transformation and competitive strategies. Students in this program will become conversant in both new technologies and business strategies. Future career possibilities include systems analysts, project leaders, IT consultants, and information resource managers, who can integrate people, process, and organization to provide creative information technology solutions.

The program follows a three-phase sequence, with each phase preparing the student for the subsequent phase. The master's degree program consists of:

- Prerequisite Phase
- Core Knowledge Phase
- Advanced Phase

Upon acceptance into the master’s degree program, the student will meet with his/her faculty advisor to discuss required courses for the Prerequisite Phase. The Prerequisite Phase ensures that all students enter graduate courses with an equivalent background. While completing this phase, a student is considered a conditionally admitted master's student. In the Core Knowledge Phase, a student will follow a sequence of courses to acquire an understanding of the technological and theoretical foundations for this degree. In the Advanced Phase of the program, the fundamental information learned previously allows a student to study advanced topics. This phase adds depth to the work completed in the Core Knowledge Phase. Individual interests and needs are also addressed through a series of elective courses chosen in consultation with the student’s faculty advisor.

GRADE AND GPA REQUIREMENTS

- Grades: Students must receive a grade of B- or better in each prerequisite course and a C- or better in all other courses.
- GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.75 and a designation of distinction on the core examinations will graduate with distinction.

PREREQUISITE PHASE

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>CSC 215</td>
<td>Introduction to Structured Programming using C++</td>
</tr>
<tr>
<td>CSC 260</td>
<td>Client Interface Programming</td>
</tr>
<tr>
<td>CSC 310*</td>
<td>Principles of Computer Science I or</td>
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<tr>
<td>CSC 336*</td>
<td>End User Application Development</td>
</tr>
<tr>
<td>CSC 323</td>
<td>Data Analysis and Statistical Software I</td>
</tr>
<tr>
<td>IS 404</td>
<td>Business Systems</td>
</tr>
<tr>
<td>ECT 410</td>
<td>Web Application Development with Scripting</td>
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</tbody>
</table>

*Students with extensive programming experience may substitute CSC 225 C++ for Programmers in place of CSC 215 and CSC 310, or may substitute CSC 280 Visual Basic for Programmers in place of CSC 260 and CSC 336. Students may also substitute CSC 260 with CSC 203.

By taking these courses and receiving a grade of a B- or better in each, the student will have completed the requirements of the Prerequisite Phase. All or part of the Prerequisite Phase may be waived if a student has the equivalent academic background. Alternatively, students with practical experience may complete a Graduate Assessment Examination (GAE) to show competency in a prerequisite. All students are blocked from enrolling in Core Knowledge Phase courses prior to completing their prerequisites. The student must submit a Change of Status request when the Prerequisite Phase is completed to inform the Student Services office that the block can be removed. The form must be submitted two weeks before the student intends to register for
graduate level classes. The student will then be considered a fully admitted student, and may pass to the Core Knowledge Phase of the program.

**CORE KNOWLEDGE PHASE**

Core Knowledge Courses. Fully admitted students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses. The Core Knowledge Phase courses for the MS in Information Systems are:

- IS 421  Information Systems Analysis
- IS 422  Information Systems Design
- IS 483  Information Systems Management

Core Knowledge Examination. These examinations cover the subject matter of the Core Knowledge Phase courses. Students have the option of taking one, two or three core exams at one time after completion of the applicable course or courses. Possible grades on the Core Examinations are Pass with Distinction, Pass, and Fail. Students are allowed at most two attempts at each exam. Two failures on one exam result in dismissal from the graduate program.

**ADVANCED PHASE**

The Advanced Phase consists of ten courses. The student can elect the standard program or one of the IS concentrations during the Advanced Phase. The standard program provides students flexibility to experience a wide range of coursework. The student may also choose one of six concentrations for course work during the Advanced Phase.

- E-Commerce Concentration
- Systems Development Concentration
- Data Warehousing Concentration
- IT Project Management Concentration
- Collaborative Technologies Concentration
- Networking Concentration

*Standard Program.* In this program, the students must complete the following three required courses. Students are advised to take IS 577 near the end of their studies.

- CSC 449  Database Technologies
- TDC 425  Voice/Data Network Fundamentals
- IS 577  Information Technology Policies and Strategies

Students must also complete three of the following courses:

- IS 450  Technological Organization Transformation
- IS 482  Legal Aspects of Information Technology
- IS 511  Social Issues of Computing
- IS 512  Groupware and Virtual Collaboration
- IS 540  Global Information Technology
- IS 549  Data Warehousing and Data Mining
- IS 553  Advanced Topics for System Development
- IS 594  Information Engineering
- ECT 595  Design and Strategies for Internet Commerce
- IS 596  Project Management
- IS 596  Enterprise Resource Planning
- IS 574  Decision Support Systems and Executive Information Systems
- IS 575  Information Retrieval
- IS 578  Information Technology Consulting
- IS 596  Topics in Information Systems
- SE 430  Object-Oriented Modeling
INFORMATION SYSTEMS

CSC 457 Expert Systems
TDC 572 Network Security
IS 690 Research Seminar
IS 696 Master’s Project
IS 698 Master’s Thesis

Two courses in one of the following areas: E-Commerce Technology, Communications, Computer Vision/Graphics, Database Systems, Distributed Systems, Human-Computer Interaction, and Software Engineering.

Two open electives (CTI courses in the range of 420-699).

CONCENTRATIONS

In addition to the courses in the Prerequisite Phase and the Core Knowledge Phase, the student may also choose one of these six concentrations for course work during the Advanced Phase:

- E-Commerce Concentration
- Systems Development Concentration
- Data Warehousing Concentration
- IT Project Management Concentration
- Collaborative Technologies Concentration
- Networking Concentration

Each concentration consists of ten courses in the Advanced Phase:

- 3 courses in the focus area
- 3 in the support areas
- 1 capstone course to be taken near the end of study
- 3 open electives (CTI courses in the range of 420-699)

E-Commerce Concentration. Students will acquire a broad set of skills in developing e-commerce solutions that support consumer-oriented online retailing, intranets, business exchange and electronic marketplaces. All these courses provide knowledge in business strategies and hands-on development experiences using different tools and technologies. Additional skills in database, interface design, networking, and e-commerce team management will prepare students to lead firms’ e-commerce strategy and application development.

ECT 555 Design and Strategies for Internet Commerce
ECT 580 Advanced Web Information Systems
ECT 581 Extranet Systems
CSC 449 Database Systems
TDC 425 Voice/Data Network Fundamentals
ECT 441 Usability Issues for E-Commerce
ECT 589 E-Commerce Management
3 open electives (CTI courses in the range of 420-699).

Systems Development Concentration. Systems developers are using new tools and methods in developing applications. Object-oriented modeling, workflow and organization modeling, process modeling, data modeling, and CASE technology are part of the tools and techniques for modern systems development. Developers also need to be conversant in project management, Internet applications, and networked enterprise management skills in order to fulfill the dual roles of new application developer and system integrator.

IS 553 Advanced Topics for System Development
IS 556  Project Management
SE 430  Object Oriented Modeling
CSC 449  Database Systems
TDC 425  Voice/Data Network Fundamentals
ECT 555  Design and Strategies for Internet Commerce
IS 577  Information Technology Policy and Strategies
3 open electives (CTI courses in the range of 420-699).

**Data Warehousing Concentration.** Data warehousing refers to the consolidation of data from many sources into a format that can be analyzed using sophisticated tools. From a business perspective, the goal of data warehousing and data mining is to gain strategic insights by identifying relationships and trends that are not otherwise apparent. IS professionals who understand the business application of data warehouse concepts, who have a user-level familiarity with data mining tools, and who are capable of designing decision support systems are in demand to fill positions as data warehousing analysts. Such positions frequently occur in ERP or web-based environments.

**CSC 449**  Database Systems
**IS 549**  Data Warehousing and Data Mining
**IS 574**  Decision Support and Expert Systems
**TDC 425**  Voice/Data Network Fundamentals
**ECT 555**  Design and Strategies for Internet Commerce
**IS 560**  Enterprise Resource Planning or
**CSC 456**  Foundations of Intelligent Databases
**IS 577**  Information Technology Policy and Strategies
3 open electives (CTI courses in the range of 420-699).

**IT Project Management Concentration.** IT project managers are experienced systems analysts who have in-depth knowledge of business practices, system development methodologies, project risk management and project control mechanisms, and a broad range of current technologies. As team leaders, project managers must understand organizational dynamics, and be skilled in dealing with users, vendors, consulting firms, and internal management. Since the systems they install are often the catalysts for major organizational change, project managers must understand the process of managing technologically triggered change within organizations.

**IS 450**  Technological Organization Transformation
**IS 556**  Project Management
**IS 560**  Enterprise Resource Planning or
**IS 578**  Information Technology Consulting
**CSC 449**  Database Systems
**TDC 425**  Voice/Data Network Fundamentals
**ECT 555**  Design and Strategies for Internet Commerce
**IS 577**  Information Technology Policy and Strategies
3 open electives (CTI courses in the range of 420-699).
Collaborative Technologies Concentration. This concentration prepares students for the management of virtual teams and the management of technology that supports virtual teams, analysis and design of virtual systems, and using collaboration technologies to undertake organizational or systems development projects. Students with this skill set may work as analysts and designers for virtual work process environments, as BPR and CRM change agents with firms that use collaborative technology to support the change process, and as consultants for firms who employ virtual work or virtual teaming environments.

IS 450  Technological Organization Transformation
IS 512  Groupware and Virtual Collaboration
IS 574  Decision Support and Executive Information Systems
IS 596  Topic: Design of Collaboration Environment
IS 540  Global Information Technology
CSC 449  Database Systems
TDC 425  Voice/Data Network Fundamentals
IS 977  Information Technology Policy and Strategies
3 open electives (CTI courses in the range of 420-699).

Networking Concentration. This concentration prepares students interested in an IS career with a focus on networked information systems. The combination of courses will provide the student with both solid IS management skills as well as technical hands-on TPC experience. Students are prepared to work for organizations that are heavily networked and require business or systems analysts who are deeply conversant in network technologies or to manage IS shops where a large component of the IS technology is network technology.

TDC 461  Basic Communication Systems
TDC 463  Computer Networks and Data Systems
TDC 564  Local Area Networks
TDC 511  Telecommunications Practicum
TDC 567  Telecommunication Systems Design and Management
ECT 355  Design and Strategies for Internet Commerce
IS 540  Global Information Technology
IS 577  Information Technology Policy and Strategies
3 open electives (CTI courses in the range of 420-699).

Elective Course Restrictions

Elective courses are in the range of 420-699 and must be from the school of CTI. Credit for courses taken outside of the school will only be given if approved by a faculty advisor. Courses suggested for any Prerequisite Phase in any concentration do not count for elective credit. Any course required for the student's concentration but taken as part of the requirements of another degree earned by the student may be waived, but cannot be used for elective credit.
MASTER OF SCIENCE IN SOFTWARE ENGINEERING

Software Engineering is a discipline concerned with the practical problems of developing large-scale software systems. Software engineers are the architects of the software component of a computer-based system, providing several levels of representations or blueprints leading to specifications through which programmers build the subsystems and modules of the system. Software development methodologies and management techniques combine with theories from mathematics and computer science in a cost-effective manner to solve real-world system development problems. This degree provides students with the theoretical foundations of software engineering, experience in team projects involving software development and management, hands-on experience with state-of-the-art tools, an understanding of advanced software development and management techniques, and exposure to the most recent developments and emerging technologies in SE.

All students complete any necessary prerequisite courses plus 13 graduate courses. All students are required to participate in an extensive team software development project using cutting-edge technologies and the Software Engineering Research Seminar to keep them abreast of this rapidly changing field. For this reason, they are not required to take a Core Knowledge Examination. However, to be admitted into the program, they need to have demonstrated through their prior coursework that they can consistently perform at a B level or higher. Students complete the requirements of one of the three concentrations: Project Management, Software Development, or Software Systems.

The Project Management Concentration of the Master of Science in Software Engineering addresses the management of the quality of software products and processes and provides coursework in management and measurement techniques.

The Software Development Concentration of the Master of Science in Software Engineering addresses the foundations, methodologies, and tools for developing high-quality large-scale software systems, with an emphasis on the technical issues of software development.

The Software Systems Concentration of the Master of Science in Software Engineering addresses the foundations and theories in designing and developing system software and tools for programming languages and software development.

The Software Engineering program has two phases:

- Prerequisite Phase
- Graduate Phase

The Prerequisite Phase ensures that all students acquire the necessary background prior to enrolling in graduate courses. All or part of the Prerequisite Phase may be waived if a student has the equivalent academic background. In the Graduate Phase, students develop as software engineering professionals by completing required courses that provide a common body of knowledge for their concentration as well as advanced courses that complement and add depth to the common body of knowledge. All students also participate in an extensive team software development project and the Software Engineering Research Seminar. Individual needs are addressed through elective courses chosen in consultation with a faculty advisor.

GRADE AND GPA REQUIREMENTS

Grades: Students must receive a grade of B- or better in each prerequisite course and a C or better in all other courses. Software engineering students must also receive a B or better in "required courses."

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.75 and a designation of distinction on the research component will graduate with distinction.
PREREQUISITE PHASE
The following courses are required for all concentrations.

- **CSC 215** Introduction to Structured Programming using C++ and
- **CSC 310** Principles of Computer Science I or
- **CSC 225** C++ for Programmers

(CSC 225 is equivalent to both CSC 215 and CSC 310. Only students with experience in programming languages should take this course.)

- **CSC 323** Data Analysis and Statistical Software I
- **CSC 415** Foundations of Computer Science I
- **CSC 416** Foundations of Computer Science II

Also required for the Software Development Concentration and the Project Management Concentration:

One advanced computer science course chosen in consultation with a faculty advisor, for example, one of the following:

- **ECT 270** Client Side Web Application Development
- **CSC 343** Introduction to Operating Systems
- **CSC 345** Computer Architecture
- **CSC 349** Databases and Data Management.
- **TDC 361** Basic Communications Systems
- **CSC 417** Foundations of Computer Science III

Also required for the Software Systems Concentration:

- **CSC 343** Introduction to Operating Systems
- **CSC 417** Foundations of Computer Science III

By taking these courses and receiving a grade of a B- or better in each, the student will have completed the requirements of the Prerequisite Phase. All or part of the Prerequisite Phase may be waived if a student has the equivalent academic background. Alternatively, students with practical experience may complete a Graduate Assessment Examination (GAE) to show competency in a prerequisite. All students are blocked from enrolling in Graduate Phase courses prior to completing their prerequisites. The student must submit a Change of Status request when the Prerequisite Phase is completed to inform the Student Services office that the block can be removed. The form must be submitted two weeks before the student intends to register for graduate level classes. The student will then be considered a fully admitted student, and may pass to the Graduate Phase of the program.

**Degree Requirements**
Students in this degree program must complete 13 courses (52 hours) beyond the Prerequisite Phase. Successful completion of the Software Engineering Program consists of:

- Completion of required courses with a grade of B or better. Students with prior coursework equivalent to any required courses may be allowed by a Software Engineering faculty advisor to take other related advanced courses as substitutes.
- Completion of advanced courses, software engineering studio, and the research component.
GRADUATE PHASE
Students may register for graduate courses only after meeting all Prerequisite Phase requirements. The Graduate Phase consists of the following components:

- required courses
- advanced courses
- software engineering studio
- research

REQUIRED COURSES

Software Development Concentration
SE 430 Object-Oriented Modeling
SE 431 Formal Software Specifications and Development I
SE 450 Object-Oriented Software Development
SE 452 Object-Oriented Enterprise Application Development
SE 455 Software Development Methods

Software Systems Concentration
CSC 447 Concepts of Programming Languages
CSC 491 Design and Analysis of Algorithms
SE 450 Object-Oriented Software Development
SE 455 Software Development Methods
CSC 448 Compiler Design or
SE 431 Formal Software Specifications and Development I

Project Management Concentration
SE 430 Object-Oriented Modeling
SE 450 Object-Oriented Software Development
SE 452 Object-Oriented Enterprise Application Development
SE 477 Software and Systems Project Management
CSC 423 Data Analysis and Regression or
SE 468 Software Measurement and Project Estimation

SOFTWARE ENGINEERING STUDIO
Students in all concentrations are required to complete the following:
SE 491 Software Engineering Studio I
SE 591 Software Engineering Studio II
The two courses must be taken as a sequence in consecutive quarters. Students will be working on a large, real project in a team. The project will be carried out from conceptualization to completion using the current technologies.

ADVANCED COURSES

- Two SE courses, one must be 500 level.
- Two electives. See elective course restrictions below.
RESEARCH
SE 690    Software Engineering Research Seminar

And one of:
SE 696    Master's Project
SE 698    Master's Thesis
SE 531    Formal Software Specifications and Development II
SE 533    Software Validation and Verification
SE 590    Advanced Topics in Object-Oriented Technology

The Master's project or thesis must represent an original contribution to the area, and may include system development, empirical studies, or theoretical work. The scope and the details of the research project will be determined by the research supervisor, and must be approved by the student's academic advisor. A special designation will be included in the transcripts and diplomas of students who choose and successfully complete the Master's project or thesis.

Elective Course Restrictions

Elective courses are in the range of 420-699 and must be from the school of CFI. Credit for courses taken outside of the school will only be given if approved by a faculty advisor. Courses suggested for any Prerequisite Phase in any concentration do not count for elective credit. Any course required for the student's concentration but taken as part of the requirements of another degree earned by the student may be waived, but cannot be used for elective credit.
MASTER OF SCIENCE IN TELECOMMUNICATION SYSTEMS

The MS in Telecommunications Systems offers extensive theoretical and practical knowledge in voice and data communications networks. Students completing this degree program have a thorough understanding of the technical and operational aspects of networks as well as the foundational theory of voice and data communications and network management.

Students in this degree program choose one of two concentrations, which determines their sequence of required courses in the Advanced Phase:

The **Standard Telecommunications Concentration** is designed for students who want to focus narrowly on practical aspects of design and management of telecommunications networks. This concentration would be appropriate for those seeking a career in corporate telecommunications management, strategic planning for telecommunications systems or marketing, and/or planning of voice and data services for a public carrier network. Included in the curriculum are courses in the technology, economics, and management of corporate telecommunications systems. Although both voice and data technologies are studied, voice applications are emphasized. This concentration requires no software development beyond the Prerequisite Phase.

The **Computer Science Concentration** is appropriate for students seeking a career in designing network software projects, engineering corporate communications networks, technical network management positions and/or technical marketing or support of networking products. Coursework includes classes in network protocols, local and wide area services, network programming and management. Required Advanced Phase courses tend to emphasize data communications networks as opposed to voice networks. This concentration requires the development of network software in some courses.

Both MS Telecommunications Systems programs follow a three-phase sequence, with each phase preparing the student for the subsequent phase. The master's degree program consists of:

- Prerequisite Phase
- Core Knowledge Phase
- Advanced Phase

Upon acceptance into the master's degree program, the student will meet with his/her faculty advisor to discuss required courses for the Prerequisite Phase. The Prerequisite Phase is intended to ensure that all students enter graduate courses with an equivalent background.

While completing this phase, a student is considered a conditionally admitted master's student. In the Core Knowledge Phase, a student will follow a sequence of courses to acquire an understanding of the technological and theoretical foundations for the particular degree. In the Advanced Phase of the program, the fundamental information learned previously allows a student to study advanced topics within their chosen degree. This phase adds depth to the work completed in the Core Knowledge Phase. Individual interests and needs are also addressed through a series of elective courses chosen in consultation with the student's faculty advisor.

GRADE AND GPA REQUIREMENTS

- Grades: Students must receive a grade of B- or better in each prerequisite course and a C- or better in all other courses.
- GPA: Students must maintain a graduate level GPA of 2.5 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.90 GPA. Students with a GPA of 3.75 and a designation of distinction on the core examinations will graduate with distinction.
TELECOMMUNICATIONS SYSTEMS

PREREQUISITE PHASE
The following five Prerequisite Phase requirements are common to both concentrations:

CSC 215 Introduction to Structured Programming using C++ or
CSC 225 C++ for Programmers
(CSC 225 is equivalent to both CSC 215 and CSC 310. Only students with experience in programming languages should take this course.)
CSC 323 Data Analysis and Statistical Software I
PHY 405 Physical Principles of Communication Systems
CSC 415 Foundations of Computer Science I
TDC 411 Computers in Information Systems and Telecommunications or
CSC 343 Introduction to Operating Systems and
CSC 345 Computer Architecture
(only TDC 411 alone or both CSC 343 and CSC 345 will satisfy this last prerequisite)

Due to required network programming courses in the Advanced Phase of the Computer Science concentration, the following additional prerequisite is required for students taking the Computer Science Concentration only:

CSC 416 Foundations of Computer Science II
Students in this concentration who have taken CSC 215 rather than CSC 225 must also complete:

CSC 310 Principles of Computer Science I prior to taking CSC 416

By taking these courses and receiving a grade of a B- or better in each, the student will have completed the requirements of the Prerequisite Phase. All or part of the Prerequisite Phase may be waived if a student has the equivalent academic background. Alternatively, students with practical experience may complete a Graduate Assessment Examination (GAE) to show competency in a prerequisite. All students are blocked from enrolling in Core Knowledge Phase courses prior to completing their prerequisites. The student must submit a Change of Status request when the Prerequisite Phase is completed to inform the Student Services office that the block can be removed. The form must be submitted two weeks before the student intends to register for graduate level classes. The student will then be considered a fully admitted student, and may pass to the Core Knowledge Phase of the program.

CORE KNOWLEDGE PHASE
Core Knowledge Courses. Fully admitted students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses. The Core Knowledge Phase courses for the MS in Telecommunications are:

TDC 461 Basic Communication Systems
TDC 462 Data Communications
TDC 463 Computer Networks and Data Systems

Core Knowledge Examination. These examinations cover the subject matter of the Core Knowledge Phase courses. Possible grades on the Core Examinations are Pass with Distinction, Pass, and Fail. Students are allowed at most two attempts at each exam. Two failures on the exams result in dismissal from the graduate program.

ADVANCED PHASE COURSES
A student must complete 40 credits (10 courses) in the Advanced Phase to earn the MS in Telecommunication Systems. All courses in the Advanced Phase must be completed with a grade of C- or better. Students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses prior to passing the Core Knowledge Examination.
**MS Telecommunications Systems / Standard Concentration**

The following six courses must all be completed:

- TDC 464 Voice Communication Networks
- TDC 476 Economics of Telecommunications Systems
- TDC 511 Telecommunications Practicum
- TDC 512 Cellular and Wireless Telecommunications
- TDC 567 Telecommunications System Design and Management
- TDC 569 Telecommunications Regulation, Policy and Law

Two of the following courses must be completed:

- IS 577 Information Technology Policy and Strategies
- TDC 514 Computer Telephony
- TDC 563 Protocols and Techniques for Data Networks
- TDC 564 Local Area Networks
- TDC 565 Voice and Data Integration
- TDC 566 Integrated Services Digital Networks
- TDC 568 Network Management

Students in the Standard Concentration of Telecommunications must also complete two elective courses. See elective course restrictions below.

**MS Telecommunications Systems / Computer Science Concentration**

The following two courses must be completed:

- TDC 511 Telecommunications Practicum
- TDC 561 Distributed Computing

Four of the following courses must be completed:

- CSC 446 Operating Systems
- TDC 432 Computer and Information System Modeling
- TDC 464 Voice Communications Networks
- TDC 489 Queuing Theory with Computer Applications
- TDC 513 Client/Server Technologies
- TDC 562 Computer Communication Network Design and Analysis
- TDC 563 Protocols and Techniques for Data Networks
- TDC 564 Local Area Networks
- TDC 565 Voice and Data Integration
- TDC 566 Integrated Services Digital Networks
- TDC 568 Network Management

Students in the Computer Science Concentration of Telecommunications must also complete four elective courses. See elective course restrictions below.

**Elective Course Restrictions** Elective courses are in the range of 420-699 and must be from the school of CTI. Credit for courses taken outside of the school will only be given if approved by a faculty advisor. Courses suggested for any Prerequisite Phase in any concentration do not count for elective credit. Any course required for the student's concentration but taken as part of the requirements of another degree earned by the student may be waived, but cannot be used for elective credit.
MASTER OF SCIENCE IN MANAGEMENT INFORMATION SYSTEMS

The Management Information Systems degree is a joint program of the School of CTI and the College of Commerce. This program is highly specialized and is geared toward a student with undergraduate training in both computer science and business. The concentration focuses specifically on information systems used by management. The computer science courses deal with the technical aspects of database and decision support systems, basic computer technology and information systems, and foundations of computer systems. The College of Commerce courses develop topics on project and system design, project and system management and the integration of information systems.

The program follows a three-phase sequence, with each phase preparing the student for the subsequent phase. The master's degree program consists of:

- Prerequisite Phase
- Core Knowledge Phase
- Advanced Phase

Upon acceptance into the master's degree program, the student will meet with his/her faculty advisor to discuss required courses for the Prerequisite Phase. The Prerequisite Phase is intended to ensure that all students enter graduate courses with an equivalent background. While completing this phase, a student is considered a conditionally admitted master's student. In the Core Knowledge Phase, a student will follow a sequence of courses to acquire an understanding of the technological and theoretical foundations for the particular degree. In the Advanced Phase of the program, the fundamental information learned previously allows a student to study advanced topics within their chosen degree. This phase adds depth to the work completed in the Core Knowledge Phase. Individual interests and needs are also addressed through a series of elective courses chosen in consultation with the student's faculty advisor.

GRADE AND GPA REQUIREMENTS

Grades: Students must receive a grade of B- or better in each prerequisite course and a C- or better in all other courses.

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.75 and a designation of distinction on the core examinations will graduate with distinction.

PREREQUISITE PHASE

The courses in the Prerequisite Phase for the MS in Management Information Systems are:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC 500</td>
<td>Financial Accounting</td>
</tr>
<tr>
<td>MKT 535</td>
<td>Decisions in Marketing Management</td>
</tr>
<tr>
<td>MGT 502</td>
<td>Managing Operations for Competitive Advantage</td>
</tr>
<tr>
<td>ACC 551</td>
<td>Management Accounting for Decision Making</td>
</tr>
<tr>
<td>CSC 215</td>
<td>Introduction to Structured Programming using C++ or</td>
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<tr>
<td>CSC 225</td>
<td>C++ for Programmers</td>
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<tr>
<td>(CSC 225 should only be taken by students with experience in programming languages)</td>
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<tr>
<td>CSC 240</td>
<td>Personal Computing for Programmers</td>
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<tr>
<td>CSC 203</td>
<td>COBOL Programming</td>
</tr>
<tr>
<td>CSC 260</td>
<td>Client Interface Programming</td>
</tr>
<tr>
<td>CSC 323</td>
<td>Data Analysis and Statistical Software I</td>
</tr>
<tr>
<td>CSC 415</td>
<td>Foundations of Computer Science I</td>
</tr>
</tbody>
</table>

By taking these courses and receiving a grade of a B- or better in each, the student will have completed the requirements of the Prerequisite Phase. All or part of the Prerequisite Phase
Management Information Systems

may be waived if a student has the equivalent academic background. Alternatively, students with practical experience may complete a Graduate Assessment Examination (GAE) to show competency in a computer science prerequisite. All students are blocked from enrolling in Core Knowledge Phase courses prior to completing their prerequisites. The student must submit a Change of Status request when the Prerequisite Phase is completed to inform the Student Services office that the block can be removed. The form must be submitted two weeks before the student intends to register for graduate level classes. The student will then be considered a fully admitted student, and may pass to the Core Knowledge Phase of the program.

Core Knowledge Phase

Core Knowledge Courses. Fully admitted students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses.

The Management Information Systems Core Knowledge Phase consists of three Computer Science courses and three Management Information Systems courses, for a total of six courses. Most students complete the courses listed below. However, students with related coursework or experience may waive some of the courses, but this requires permission of the advisor. Waived courses are replaced with approved electives. Students are still responsible for the content of these courses on the Core Knowledge Examination. The course requirements are:

Management Information Systems (Does not require an examination)
MIS 500 Management of Information Technology
MIS 676 Systems Planning and Implementation
MIS 677 Information Systems Project Management

Computer Science

IS 421 Information Systems Analysis
IS 422 Information Systems Design
IS 483 Information Systems Management

Core Knowledge Examination. These examinations cover the subject matter of the Core Knowledge Phase courses. Students have the option of taking one, two or three core exams at one time after completion of the applicable course or courses. Possible grades on the Core Examinations are Pass with Distinction, Pass, and Fail. Students are allowed at most two attempts at each exam. Two failures on one exam result in dismissal from the graduate program.

Advanced Phase Courses

The Advanced Phase consists of seven graduate level courses. Students must fulfill the course requirements in both Management Information Systems and Computer Science. Three of these courses must be selected from the Advanced Phase Management Information Systems courses, and three from the Advanced Phase Computer Science courses. The seventh course must be chosen from an MIS or a Computer Science elective (To be approved by the advisor). In individual cases, the student's advisor may waive of some of these courses, but they must be replaced by approved electives.
Management Information Systems

Students must take at least three courses from the following list. In individual cases, the student's advisor may substitute electives for some of these courses.

- **MIS 672** Advanced Information Systems Topics
- **MIS 674** Systems Analysis and Design
- **MIS 683** Information Technology Strategy and Architecture
- **MIS 684** Ethical and Social Issues in Information Technology
- **MIS 689** Knowledge Management
- **MIS 798** Special Topics

Students who have extra Management Information Systems electives, due to waiving some of the required courses, should choose from the following courses with the permission of the MIS program director.

- **MGT 506** Effective Process Design
- **MGT 508** Quality Management Systems
- **MGT 510** Quality Improvement Methods
- **MGT 530** Leadership in Organizations
- **MGT 535** Change Management
- **MGT 590** Management of Innovation and Technological Change
- **MIS 675** Emerging Technologies
- **MIS 799** Independent Study

Computer Science

Students must take the following three Advanced Phase Computer Science courses:

- **CSC 449** Database Systems
- **TDC 425** Voice/Data Network Fundamentals
- **IS 577** Information Technology Policies and Strategies

With the permission of Dr. Martin Kalin, program administrator for CTI, students may also take other graduate courses offered by CTI.
MASTER OF ARTS IN APPLIED TECHNOLOGY

The Master of Arts in Applied Technology (MAAT) is designed for experienced non-IT managers who wish to acquire advanced technical skills in a highly focused area, in combination with enhanced understanding of the larger organizational, economic, and social contexts within which these technical skills are practiced. The MAAT offers Areas of Specialization in either Applied Information Systems (AIS) or Applied Telecommunications Systems (ATS). This new degree program is being offered jointly by CTI and the School for New Learning (SNL). DePaul's nationally recognized college for adult learners, and students work with advisors from both colleges throughout their program. Students entering the MAAT must have an undergraduate degree with an appropriate GPA, although it need not have been in a technology-related field. They must also have had experience in the workplace sufficient to define the technological requirements of an organization as well as to understand the organization system itself (generally, at least three years), and must have access to a worksite "laboratory" within which the application of learning can take place.

The curriculum consists of three primary components:
- An individualized Area of Specialization in either Applied Information Systems or Applied Telecommunications offered through CTI: the Area of Specialization combines CTI coursework with on-the-job application of this coursework;
- A series of Liberal Learning Seminars offered through SNL which are designed to develop the skills of communication, interpersonal facility, problem-solving, analytical and systems thinking, ethical decision-making, and self-managed learning; and
- A Culminating Project which is designed to integrate the technical and liberal learning components of the program through the design and/or implementation of a major professional project in the workplace.

GRADE AND GPA REQUIREMENTS

Grades: Students must receive a grade of B- or better in each prerequisite course and a C- or better in all other courses.

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.75 and a designation of distinction on the core examinations will graduate with distinction.

PREREQUISITE PHASE:

The Prerequisite Phase is intended to ensure that all students enter CTI coursework with adequate preparation for successful work. Because the MAAT program admits only experienced practitioners, each student's background and abilities will be assessed jointly by members of both the CTI and SNL faculty. Students may receive waivers for the Prerequisite Phase based on prior experience, previous coursework, or performance on a Graduate Assessment Examination (GAE). The following coursework constitutes the Prerequisite Phase for each Area of Specialization:

**Applied Information Systems**
- CSC 240 Personal Computing for Programmers
- CSC 203 Cobol Programming or
- CSC 260 Client Interface Programming (Visual Basic)
- IS 404 Business Systems

**Applied Telecommunications**
- CSC 240 Personal Computing for Programmers
- CSC 260 Client Interface Programming (Visual Basic)
- TDC 411 Computers in Information Systems and Telecommunications
CORE KNOWLEDGE PHASE:
Students must complete the three core courses in their Area of Specialization:

Applied Information Systems
IS 421 Information Systems Analysis
IS 422 Information Systems Design
IS 483 Information Systems Management

Applied Telecommunications
TDC 461 Basic Communications Systems
TDC 462 Data Communications
TDC 463 Information Systems Management

ADVANCED PHASE:
After completing the courses in the Core Phase, students select three Advanced Phase courses from among the following:

Applied Information Systems
IS 482 Legal Aspects of Information Technology
IS 450 Technological Organization Transformation
IS 511 Social Issues of Computing
IS 512 Groupware and Virtual Collaboration
IS 540 Global Information Technology

Applied Telecommunications
TDC 464 Voice Communication Networks
TDC 476 Economics of Telecommunications
TDC 511 Telecommunications Practicum
TDC 512 Cellular and Wireless Telecommunications

SNL LIBERAL LEARNING SEMINARS:
All MAAT students are assigned to a cluster of approximately 20 students. These students remain together through the seven quarters of SNL seminar work.

SNL 700 Learning Plan Research and Development
SNL 725 Applying Research Methods
SNL 735 Understanding Personal and Organizational Change
SNL 745 Improving Team Effectiveness
SNL 755 Valuing Human Differences
SNL 765 Engaging Ethical Reasoning
SNL 775 Exercising Effective Leadership

Ordinarily, a student will take one SNL seminar concurrently with one CTI course to encourage the integration of technical and liberal learning throughout the program.

CULMINATING PROJECT:
The Culminating Project is an independent project that demonstrates a student’s ability to integrate both technical expertise and organizational acumen. Typically, it involves the identification of a practice-based problem, the development and implementation of an appropriate intervention, and the evaluation of the strengths and limitations of the intervention. Normally, it is undertaken after all other work in the Area of Specialization and the Liberal Learning Seminars has been completed. In this work, the student is guided and later assessed by the SNL Faculty Mentor, a Professional Advisor from CTI, and an outside assessor who has experience specific to the student’s area of practice.

For more information see the School of New Learning’s website.
DOCTOR OF PHILOSOPHY IN COMPUTER SCIENCE

The Ph.D. program in Computer Science offers an opportunity for exceptional students to pursue substantial research in the computer sciences and related areas. The program is highly selective and is intentionally kept small so that each Ph.D. student can receive substantial advising and mentoring from CTI faculty. To earn a Ph.D. degree, a student must demonstrate breadth of knowledge in at least three research areas and significant depth in a chosen dissertation area. In addition, the student must conceive, write and defend a Ph.D. dissertation representing a significant and original contribution to current academic research as demonstrated by a public dissertation defense and publication in established peer-reviewed academic conferences and/or journals.

In keeping with the CTI philosophy of blending academic and professional pursuits, full-time employed students will be considered for admission as part-time doctoral students. However, these applicants must have sufficiently flexible work schedules to allow them to attend required meetings and academic seminars that occur during daytime working hours throughout their degree program. In addition, many working students will find that they must take a leave of absence or cut back to part-time employment for some time period during the research and candidacy phases of the degree program.

ADMISSION REQUIREMENTS

In order to be considered for admission to the doctoral program, a student must:

- Hold a master's degree in Computer Science or an allied field.
- Submit three letters of recommendation.
- Show definite promise for completing the program.
- Submit a written statement describing his/her accomplishments, goals and interests.
- Submit a completed application form.
- Submit an official score report of the Graduate Record Examination (GRE) general examination.

Applicants educated outside of the United States must demonstrate English proficiency with a TOEFL score of 580 or greater.

Students without a master's degree in computer science or an allied field may be considered for conditional admission to the doctoral program. These students must have an exceptional undergraduate record. A conditionally admitted student will be required to complete a doctoral prerequisite phase consisting of a set of courses determined to be appropriate for the student by the Ph.D. committee. These courses will include the core courses from the Masters of Science in Computer Science program. Upon completion of the prerequisite phase, the Ph.D. committee will conduct an evaluation of the student's progress. Assuming such progress is satisfactory, the student will then be formally admitted into the doctoral program.

Note: It is not the policy of the School to award a master's degree to a student enrolled in the Ph.D. program.

The Ph.D. Admissions Committee determines which applicants will be admitted to the program. Because the School admits only a limited number of students to the Ph.D. program, meeting the admission standards does not guarantee acceptance.

Students employed outside of the University can be admitted as part-time doctoral students. Students who can devote themselves full time to their doctoral studies can be admitted as full-time doctoral students. Only full-time students will be considered for substantial financial aid stipends.

Completeness of credentials

When important pieces of information such as transcripts are lacking, the school is compelled by University regulations to withdraw the application.
Overview of the Degree

The Doctor of Philosophy in Computer Science degree follows three phases, which may overlap in time:

- **Inquiry Phase:** Coursework, initial research projects and successful completion of two Breadth Examinations.

- **Research Phase:** Focused research leading to successful completion of one Depth Examination and a Dissertation Proposal. Upon completion of all requirements, the student is admitted to Candidacy.

- **Candidacy Phase:** Further research, writing and defense of the Ph.D. dissertation.

The Inquiry Phase

During the Inquiry Phase a student will complete coursework in various areas of Computer Science to gain breadth and to discover the area in which dissertation research is to be done. Since considerable thought should be given to choosing the area in which the student wishes to do research in the future, the student should do small research projects during this time period to explore where his/her research interests lie.

Two Breadth Examinations must be successfully completed in research areas outside of the area in which dissertation research is planned. These examinations can be taken either during the Inquiry Phase or during the Research Phase. Each Breadth Examination will verify that the student has knowledge sufficient to teach an introductory graduate course in that area. A student is allowed to fail at most one Breadth Examination attempt.

A Ph.D. student enters the Research Phase when he or she has chosen an area in which to do dissertation research and has found a faculty member willing to act as his/her Dissertation Advisor. The amount of time spent in the Inquiry Phase will vary from student to student, but will typically be several years.

The Research Phase

In this phase the doctoral student, in conjunction with his or her Dissertation Advisor, will conduct extensive readings in academic texts, journals and conference proceedings to become an expert in the chosen research area.

A Depth Examination will be administered to test the student’s depth of knowledge and ability to perform research in the chosen area. This examination will have a written component and may have an oral component, depending on the area chosen. A student can attempt a Depth Examination at most twice.

The student is responsible for approaching a faculty member to act as his/her Dissertation Advisor. The faculty member may request that the student perform additional projects or research before agreeing to be the Dissertation Advisor. The student and Dissertation Advisor then work together to choose three additional faculty which, together with the Dissertation Advisor, form the Dissertation Committee. Three of the members must be full-time faculty members in the School of Computer Science, Telecommunications and Information Systems. The fourth committee member must be a faculty member from outside the division of the research, or a scholar from outside the School of CTI whose expertise is pertinent to the topic of the dissertation. The members of this committee must be approved by the School’s Ph.D. Committee.

Once the student has enough preliminary results that the student and advisor are confident that the work should result in publishable results, the student will write an extensive review of previous work in the area and a research proposal for the dissertation research. The Dissertation Committee members will then choose a date for a public defense of the dissertation proposal. The student will provide an oral presentation of current results and future research goals at this defense. The proposal will be approved only if the Dissertation Committee agrees that the work that is planned will constitute an acceptable Ph.D. dissertation.
The committee may recommend that the student repeat the proposal at a later date.

A student generally enters the Candidacy Phase (and is considered a Candidate) after a successful defense of the Dissertation Proposal (see the full requirements for Candidacy below).

The Candidacy Phase

In the Candidacy Phase the student performs the research promised in the dissertation proposal and writes the dissertation. Ph.D. dissertations in Computer Science are typically 100 to 300 pages in length and must represent a significant and original body of work.

Except in very unusual situations, the student will be required to publish some portion of the dissertation as an academic paper in a refereed journal or conference before completing the degree. This will demonstrate that the significance of this work is recognized in academic communities outside DePaul University.

After the dissertation has been written, the student will provide a copy to all members of the Dissertation Committee. After reading the dissertation, the Dissertation Committee must recommend whether or not a public dissertation defense should proceed. In particular, the members of the Dissertation Committee will determine whether the completed dissertation embodies the work that was promised in the dissertation proposal. The committee may recommend modifications or additional research to be completed before the defense can take place. Once the Dissertation Committee agrees that the defense should take place, a date will be scheduled for the dissertation defense. After the defense, the Dissertation Committee will determine whether all work has been satisfactorily completed or additional work or modifications must be made.

A bound copy of the dissertation and the abstract must be presented to the DePaul Library where it will be permanently available to current and future DePaul students. Consult the Handbook for Graduate Studies at the back of this bulletin for information on submitting the dissertation and abstract to the School. Contact the Student Services office for additional information regarding procedures to follow for binding the dissertation.

Detailed Degree Requirements

Course Requirements

Ph.D. students with a master's degree are required to complete a minimum of 60 credits (typically 15 courses) of graduate classes. These credits must include at least 44 credits of courses in the 420-599 range, (including four credits of CSC 426, Values and Computer Technology), four credits of CSC 690 Research Seminar, and 12 credits of CSC 699 Research. Students may enroll in CSC 699 only after completion of the Breadth Examinations. Conditionally admitted students must complete an additional 52 credits (typically 13 courses) of graduate classes, including at least 36 credits of courses in the 420-599 range. The written approval of the Ph.D. Committee is required, before registering, to apply courses taught outside the School towards the doctoral program course requirements.

Student progress will be evaluated annually. Students must maintain a grade point average of 3.5 or better to remain in good standing in the program. Any course grade below B- is unsatisfactory and will not be counted toward degree requirements. The Ph.D. Committee will ask a student to withdraw from the doctoral program if the members judge that that student is not progressing satisfactorily toward the degree.

Continuous Enrollment

Prior to candidacy, a student must continuously enroll for at least one academic credit per quarter during every Autumn, Winter and Spring quarter. A student may apply to the Ph.D. committee for a leave of absence from this continuous enrollment requirement if exceptional circumstances arise. After admission to candidacy, a student must continuously enroll for at least one course per quarter during every Autumn, Winter and Spring quarter, but may enroll
for CSC 701, Candidacy Continuation (0 academic credits) with advisor's approval.

**ADMISSION TO CANDIDACY**

To be admitted to candidacy, doctoral students must complete the following:

**Residency:** Three quarters of full-time study must be completed at DePaul University beyond the master's level. Full-time study is defined as registration for a minimum of eight credit hours (typically two courses) per quarter. With prior approval of the Ph.D. Committee, students may satisfy residency requirements by coursework, participation in seminars, or research performed off campus.

**Allied Course:** Complete CSC 426 Values and Computer Technology

**Doctoral Examinations:** Pass two Breadth Examinations and one Depth Examination.

**Defense of Proposal:** Successfully defend a Dissertation Proposal.

**Doctoral Examinations**

- Breadth and Depth examinations are typically offered twice each year. Applications to take these exams must be completed three months prior to the exam date. A student can fail at most one Breadth Examination and one Depth Examination. Any student who fails two Breadth Examinations or two Depth Examinations will be asked to leave the program.
- Reading lists and copies of previous Breadth examinations are available. The reading list for each examination defines the specific subject areas covered by that examination.
- Examinations are offered in each of the following areas:
  - Artificial Intelligence
  - Communications Networks
  - Theoretical Computer Science
  - Information Systems
  - Data Analysis
  - Database Systems
  - Human-Computer Interaction
  - Operating Systems
  - Visual Computing
  - Programming Languages
  - Software Engineering
  - Software Management

**Program Time Limitations**

For part-time doctoral students, time limits are as follows:
- No more than four years between admission to the doctoral program and completion of Breadth and Depth Examinations.
- No more than two years between completion of Breadth and Depth Examinations and admission to Candidacy.
- No less than eight months and no more than five years between admission to Candidacy and the dissertation defense.

For full-time doctoral students, time limits are as follows:
- No more than three years between admission to the doctoral program and completion of Breadth and Depth Examinations.
- No more than two years between completion of Breadth and Depth Examinations and admission to Candidacy.
- No less than eight months and no more than five years between admission to Candidacy and the dissertation defense.

Consult the Handbook for Graduate Studies at the back of this bulletin for graduation application deadlines and the deadline for submitting completed dissertations.
COURSES
All courses carry four hours of credit unless otherwise indicated.

UNDERGRADUATE COURSES
These courses count only for Prerequisite Phase requirements.

ART 105 Two-Dimensional Foundations. Development of perceptual ability through the
analysis of two dimensional concepts of line, shape, value, texture, color, space,
and organization.

ART 305 Advanced Color Design. Advanced explorations into the use of color in both paint
and computer applications. Prerequisite: ART 105.

CSC 203 COBOL Programming. An introduction to programming in the business oriented
language COBOL. The emphasis will be on business problems involving the pro-
cessing of large quantities of data.

CSC 215 Introduction to Structured Programming. An introduction to structured computer
programming using ANSI C++. Topics include: simple data types, control struc-
tures, character string processing, array processing, functions and structures.
Prerequisite: Undergraduate corequisite is MAT 140.

CSC 225 C++ for Programmers. Introduction to C++ for persons with previous program-
ing experience in some high-level language other than C or C++. Basic
input/output (e.g., cin, cout), variables, operators, control flow, functions, pro-
gram structure, arrays, pointers, storage classes, type qualifiers, classes, con-
structors, destructors, introduction to templates, dynamic storage allocation
(new, delete). Prerequisite: Experience in at least one high level programming
language.

CSC 240 Personal Computing for Programmers. Introduction to relational database con-
cepts using PC databases, data access methods, structured query language
(SQL), query by example; networks and the use of networks to share data;
spreadsheets and macro languages. Prerequisite: CSC 110 or CSC 150.

CSC 280 Visual Basic for Programmers. An accelerated introduction to Visual Basic. Top-
ics include: intrinsic controls, event driven programming, variables, control flow,
arrays, collections, database programming, user defined classes, and ActiveX
controls. Prerequisite: At least one quarter of a high level programming
language.

CSC 310 Principles of Computer Science I. Conceptual models of a computer, machine
and assembly language. Internal data representation, programming methods, recur-
sion, stacks, queues. Prerequisite: CSC 215.

CSC 314 Programming in Java. An introduction to programming in Java for students
already having programming experience in an object-oriented language. Topics
are: Java datatypes, expressions, objects, basic I/O, applications, applets, the
Java event model. As time permits, additional advanced topics will be discussed
such as IDBC, object serialization, and network programming. Prerequisite: CSC
310 or CSC 336.
CSC 315  **Analysis and Design Techniques.** Analyzing a problem requiring a computer-based solution, designing a solution, prototyping the solution in a 4th generation language, testing the prototype. Structured analysis and design techniques, data flow and control flow programming, the data/project dictionary, processing narratives, architectural design, detailed design, transform and transaction flow, program design language, technical reviews, inspections and walk throughs. Comparison of structured techniques to alternative approaches. A team project will be required to motivate these topics.  **Prerequisite:** CSC 215

CSC 323  **Data Analysis and Statistical Software I.** Programming in the statistical language SAS. Introduction to data analysis, elementary statistical inference. Regression and correlation.  **Prerequisites:** CSC 310 or CSC 415, and MAT 140.

CSC 343  **Introduction to Operating Systems.** A brief history of operating systems development; the four basic components—file systems, processor scheduling, memory management, and device scheduling; deadlock; concurrency; protection; distributed systems.  **Prerequisites:** Undergraduate CSC 311; Graduate CSC 416.

CSC 345  **Computer Architecture.** Introduction to digital logic; microprogramming; further topics.  **Prerequisites:** Undergraduate CSC 312; Graduate CSC 416.

CSC 373  **Information Systems.** Development of information system applications at the strategic, tactical and operational levels. Systems theory and concepts, quality decision-making, the organizational role of information technology, and roles of people using, developing and managing systems.  **Prerequisite:** CSC 240.

CSC 415  **Foundations of Computer Science I.** Iteration, induction, and recursion; asymptotic analysis; proofs of correctness; elementary combinatorics; sets, propositional logic, predicate logic.

CSC 416  **Foundations of Computer Science II.** List, tree and graph abstract data types; templates, inheritance, virtual functions, and abstract classes in C++.  **Prerequisite:** CSC 225 or CSC 310.  **Co-requisite:** CSC 415.

CSC 417  **Foundations of Computer Science III.** Hash table data model, self-balancing trees, set data model, regular expressions, context-free grammars, finite-state automata.  **Prerequisite:** CSC 416.

ECT 270  **Client Side Web Application Development.** A study of HTML, DHTML, Cascading Style Sheets, authoring tools, and fundamentals of client-side scripting, JavaScript, CGI, and XML. Students will develop simple web site using DHTML and JavaScript.

ECT 410  **Web Application Development with Scripting.** Application development for e-commerce. Includes development of small-scale e-commerce transaction applications. Students will design and build retail Web site that accesses a database for online order processing using server-side Active Server Page technology.  **Prerequisite:** ECT 270, CSC 225 or CSC 260 or equivalent programming knowledge in another language.

HCI 402  **Foundations of Digital Design.** Shape, line on two-dimensional surfaces. Color. Composition rules as they apply to digitally created documents. Digital manipulation of two-dimensional images. Use of commercially available draw and paint tools to create two-dimensional designs.
JS 404 Business Systems. A study of the process of managing organizational information. The approach presented focuses on the way managers, groups and organizations use information, how that information is acquired, what technology is available, and the business systems that organizations use to manage information. Business systems that are explored include accounting, human resources, automation, transaction processing, management and strategic information systems. Students will evaluate a commercial software product through research.

TDC 411 Computers in Information Systems and Telecommunications. An introduction to computer organizations and operating systems. Computer components and functions, logic circuits, internal processing, multiprocessing, timesharing, memory management, file management, interrupts and I/O peripheral devices. Prerequisite: MAT 140 or equivalent.

MAT 140 Discrete Mathematics I. Boolean algebra, graph theory, and combinatorial analysis with computer applications. Prerequisite: MAT 131 or three years of high school mathematics.

MAT 145 Calculus for Information Systems. Limits, continuity, the derivative and rules of differentiation, applications of the derivative, exponential and logarithmic functions, the definite integral and some methods of integration, improper integrals. Prerequisite: MAT 141.

MAT 150 Calculus I. Limits and derivatives, extrema, curve sketching, convexity, inverse functions, continuity. Prerequisite: MAT 131 or three years of high school mathematics.

MAT 151 Calculus II. Definite and indefinite integral, volume, arc length, trigonometric functions, logarithmic and exponential functions. Prerequisite: MAT 150.

MAT 220 Linear Algebra with Applications. (For non-mathematics majors.) Systems of linear equations, matrices and matrix algebra, determinants, applications to linear programming, graph theory, etc. Prerequisite: MAT 150.

PHY 405 Physical Principles of Telecommunications. The course intended for non-majors treats the basic concepts of physics on which communications are based, such as basic electricity, circuit elements, transmission lines, and fibers. Included will be a discussion of combinational and sequential digital circuits. The format consists of lecture and laboratory exercises. Prerequisite: Mathematics 151 or equivalent.

PSY 105 Introductory Psychology I. History and present status of psychology; statistics as a research tool; human development, learning, memory, and intelligence; personality, stress and coping; social psychology. 105 and 106 will include a research participation requirement of no more than six hours.

PSY 347 Social Psychology. Survey of social psychological theory and research on how individual behavior, thoughts and feelings are influenced by the social context in which they occur. Prerequisite: PSY 105 or PSY 106.

PSY 380 Industrial and Organizational Psychology. Application of theories and methods of psychology to the study of human behavior in business, industrial and other organizations. Prerequisites: PSY 105 or PSY 106.

PSY 383 Engineering Psychology (crosslisted with PSY 443). Application of experimental psychology and individual differences to the design of man-machine systems, work environments, and living environments. Prerequisite: PSY 380 or consent.
GRADUATE COURSES

COMPUTER SCIENCE COURSE OFFERINGS

Completion of the Prerequisite Phase is required for all courses not listing specific prerequisites.

CSC 423  Data Analysis and Regression. Multiple regression and correlation, residual analysis, analysis of variance, and robustness. These topics will be studied from a data analytic perspective, supported by an investigation of available statistical software. Prerequisite: CSC 323 or a previous statistics course or consent of instructor.

CSC 424  Advanced Data Analysis. Topics chosen from among discriminant analysis, principal components analysis, factor analysis, and non-parametric statistics. Prerequisite: CSC 423 or consent.

CSC 426  Values and Computer Technology. The impact of computerized technologies on society with particular attention paid to the ethical issues raised by these social effects. The course will require of all Ph.D. students research leading to a paper of publishable quality. Techniques for this type of research and writing will be discussed. An oral presentation of the research of that paper will also be required.

CSC 428  Data Analysis for Experimenters. The analysis of experiments in the computing science with special emphasis on the use of statistical software and interpretation of generated output. Prerequisite: CSC 423 or consent of instructor.

CSC 434  Object-Oriented Programming. An introduction to object-oriented concepts and programming. Object-oriented applications, object-oriented database systems, architectural issues in object-oriented systems, and areas of research in object-oriented systems will be examined.

CSC 438  Survey of Computer Animation. Survey of methods used in computer animation. This course uses commercially available software packages to teach techniques for animation and digital video production. The techniques covered include storyboarding, key frame animation, audio and video editing. Prerequisite: CSC 470 or CSC 471.

CSC 444  Automata Theory and Formal Grammars (formerly CSC 493). An introduction to the most important abstract models of computation and their applications: finite-state machines and pushdown automata. The relationship between formal grammars and automata. Prerequisite: CSC 415.


CSC 448  Compiler Design. Design and structure of high level languages. Lexical scan, top down and bottom up syntactic analysis. Syntax-directed translation and LR(k) grammars. Prerequisite: CSC 447.

CSC 449  Database Technologies. An introduction to database technology and systems including database architecture, data models, query languages, integrity, security, functional dependency and normalization. Prerequisite: CSC 415 or ECT 410 and CSC 315 or IS 422.
CSC 451  **Database Design.** Design methodologies. Requirement formulation and analysis; conceptual design, implementation design, physical design. Emphasis will be on data modeling techniques. Class team projects include the design of a complete database structure and implementations of design tools. **Prerequisite:** CSC 449.

CSC 452  **Database Programming.** Programming in large-scale relational database environment using host languages such as C. Design and implementation of online applications and report generations. Micro-computer Database System programming. Concepts such as database integrity, transactions, transaction recovery, concurrency and record locking will be covered. **Prerequisites:** CSC 416 and CSC 449.

CSC 453  **Client/Server Database Application Development.** This course covers the following topics: differences between client level interfaces and embedded SQL, layered architecture of the environments (driver managers, drivers, configuration of data sources), how the architecture of the API's achieve database independence, categories of API functions (e.g., metadata, data manipulation and transaction management). Students will develop database applications in a client/server environment by using Visual Basic and ODBC as well as Java and JDBC. **Prerequisites:** CSC 336 and CSC 449.

CSC 456  **Foundations of Intelligent Databases.** An introduction to the use of logic and deduction in databases and artificial intelligence. Topics will include propositional logic, first order predicate calculus, resolution, theorem proving, deductive retrieval and deductive databases, inference engines, logic programming, and truth maintenance systems. **Prerequisites:** CSC 415.

CSC 457  **Expert Systems.** A detailed study of the development of artificial intelligence-based expert systems applications. Students will use commercial expert systems packages to develop example applications programs. Topics will include frames and other knowledge-representation techniques, rule-based and case-based systems, inference, and model-based reasoning.

CSC 458  **Symbolic Programming.** Basic concepts of symbolic programming as embodied in the language LISP. Techniques for prototyping and building conceptually advanced systems in an environment that encourages procedural and data abstraction. Topics include basic programming techniques, symbolic expressions, recursion, advanced data and control structures, object-oriented programming in CLOS, and symbolic control of TCP/IP connections. MIDI sequencing, text-to-speech, and speech recognition. Assignments will focus on basic AI techniques, but the class is intended for anyone who will need to rapidly develop large complex systems.

CSC 469  **Computer Graphics I.** Basic graphics architecture. Coordinate systems. Three-dimensional representations and transformations. Simple visible-surface algorithms. Introduction to illumination. Gouraud and Phong shading. Antialiasing. Texture mapping and elements of animation. Students create an entire graphics package using high-level API such as OpenGL. **Prerequisites:** CSC 417 and either MAT 151 or MAT 145.
CSC 470  Survey of Computer Graphics. Overview of selected 2D techniques including compositing, and morphing, and a survey of basic 3D techniques, including interaction of light and color. Multimedia. Virtual Reality. Students write parts of a raytracer and create an animation. Prerequisite: CSC 215 or CSC 225 or CSC 255 or CSC 260.

CSC 480  Foundations of Artificial Intelligence (formerly CSC 556). This course will provide an in-depth survey of important concepts, problems, and techniques in Artificial Intelligence. A particular focus and a unifying theme in the course will be the concept of "intelligent agents." No previous knowledge of AI is necessary to take the course. The course is particularly suitable for graduate and advanced undergraduate students who want to gain the technical background necessary to build intelligent systems, or as a preparation for more advanced work in AI. The concepts and techniques learned in this course will be directly applicable to many other areas of computing sciences, including software design, distributed systems, databases, and information management and retrieval. Prerequisite: CSC 416.

CSC 481  Pattern Recognition and Image Processing. Image processing, edge detection, segmentation, feature extraction, decision boundaries, Bayesian classifiers, nearest neighbor classifiers, clustering, neural nets. Prerequisite: CSC 323 or equivalent.


CSC 487  Operations Research I. Linear Programming. The Linear Programming problem and its dual, the simplex method, transportation and warehouse problems, computer algorithms and applications to various fields. Prerequisites: MAT 220 and any introductory programming course.

CSC 488  Operations Research II. Optimization Theory. Integer programming, nonlinear programming, dynamic programming, game theory. Prerequisite: CSC 487.

CSC 491  Design and Analysis of Algorithms. Methods of designing algorithms including divide-and-conquer, the greedy method, dynamic programming, and backtracking. Emphasis on efficiency issues. Prerequisite: CSC 417.

CSC 496  Microprocessors. An introduction to the hardware and software aspects of microprocessors. Digital electronics, microprocessors, programming, interfacing. Laboratory work will involve hands-on work with microprocessor systems. Prerequisite: one assembler course

CSC 497  Information Theory. An introduction to the basic concepts of information theory and coding theory. Measure of information, the fundamental theorem, Hamming, BCH, and other cyclic codes.
CSC 498  **Digital Signal Processing.** Elements of circuit and signal theory, theory of modulation, mathematical basis of sampling and coding, principles of digital filtering, applications to communications, process control, image and voice recognition, voice synthesis.

CSC 502  **Genetic Algorithms.** The basics of genetic algorithms, the schema theory of John Holland, advanced operators and genetic search, as well as applications, e.g. genetic-based machine learning, parsing, expert systems, etc. Students will work on a variety of projects based on the applications discussed in class. **Prerequisite:** CSC 491.

CSC 503  **Parallel Algorithms.** Development, implementation, and applications of parallel algorithms. Models of parallel computation. Parallel sorting, searching and graph algorithms, as well as other parallel algorithms, will be studied and implemented on both simulated and actual parallel machines. **Prerequisite:** CSC 491.

CSC 504  **Parallel Processing.** Specific multiprocessor architectures and how to implement various algorithms on each machine. Students will implement a fairly large project on a multiprocessor. The course will also introduce some compilation techniques, for a better understanding of the issues. **Prerequisite:** CSC 491.


CSC 538  **Vision Systems.** A survey of working vision systems such as bar code readers, handwriting readers, robotic navigation systems, target acquisition and tracking systems. **Prerequisite:** CSC 481 or CSC 584.


CSC 544  **Theory of Computation (formerly CSC 490).** Advanced topics in the mathematical foundations of computation. Topics may include random access and Turing machines, recursive functions, algorithms, computability and computational complexity, intractable problems, NP-complete problems. **Prerequisite:** CSC 444.

CSC 545  **Advanced Computer Organization.** Parallel, array and pipeline processors and other topics of current interest. **Prerequisite:** CSC 345.

CSC 546  **Operating Systems Design.** A project/seminar oriented course examining the details of the design of operating systems. The ideas from CSC 446 will be extended and incorporated into the design details. **Prerequisite:** CSC 343.
CSC 547  **Advanced Topics in Program Languages.** A project-based course on advanced topics related to programming languages and programming environments. The course does not have any formal exams or homework assignments, but participants are expected to read papers on current research, actively participate in discussions, and complete a significant course project. **Prerequisite:** Permission of the instructor.

CSC 548  **Advanced Compiler Design.** Emphasis on practical problems in implementing compilers, data flow analysis, code optimization, error analysis. Discussion of compiler generators. As a class project, students will write a compiler. **Prerequisite:** CSC 448.

CSC 549  **Advanced Database Systems.** Physical data organization and database indexes. Query processing and optimization. Failure and recovery in database systems. Concurrency control and transaction management. Selected topics: intelligent databases, temporal databases, multimedia databases, spatial databases, fuzzy databases, etc. **Prerequisite:** CSC 449.

CSC 550  **Object-Oriented Databases.** Introduction to object-oriented concepts: abstract data typing, inheritance, object identity. Architecture, modeling and design for object-oriented databases. Query languages, integrity, long-duration transactions, concurrency, recovery and versioning in object-oriented databases. Brief survey of commercial and research prototypes of object-oriented database management systems. **Prerequisite:** CSC 449.

CSC 551  **Distributed Database Systems.** Distributed database architecture, distributed database design, distributed query processing, query decomposition and optimization of distributed queries, distributed transaction management and concurrency control, distributed DBMS reliability, distributed database operating systems. Distributed multidatabase systems. Client/Server database systems. **Prerequisite:** CSC 449 and TDC 463.

CSC 570  **Visualization.** Reconstruction techniques. Voxel classification and isosurface generation. Spatial set operations. Projections of higher-dimensional data sets. Data feature enhancement. False color mapping. Survey of applications in science, engineering and medicine. **Prerequisites:** CSC 469 and CSC 436.

CSC 571  **Principles of Computer Animation.** **Prerequisite:** CSC 469 and MAT 152.

CSC 574  **Computer Games.** Concept and character development, storyboarding, prototyping, testing and implementation. Interaction techniques. Optimization of lighting and texture. Discussion of relevant hardware and peripherals. **Prerequisite:** CSC 469.

CSC 575  **Advanced Graphics Development.** Survey of standards and current modular technology for 2D and 3D graphics software development. Use of software development toolkits to create "plug-ins" and other modularly organized functionality enhancements for selected commercially available graphics packages. **Prerequisite:** CSC 469 or consent of instructor.

CSC 578  **Neural Networks.** A study of the basic structure of neural networks, activation and weights computation, learning, and various models. Competition, pattern association, supervised and unsupervised learning units, single and multilayer models, Hopfield nets, Boltzmann machines, and others. Some current applications are explored. **Prerequisite:** MAT 150 or MAT 145.
CSC 582  **Machine Learning.** An introduction to computer systems that learn. Classification methods, decision-tree induction methods, learning concepts from examples, learning heuristics, learning by analogy: explanation-based and case-based learning. *Prerequisite: CSC 456.*

CSC 583  **Natural Language Processing.** Introduction to computer understanding of natural (human) languages. Topics include knowledge representation, syntactic analysis and grammars, parsing, semantic interpretation, discourse analysis, text generation, and machine translation. An overview of several existing natural language processing systems. *Prerequisite: 417.*

CSC 584  **Computer Vision.** An introduction to computer vision, including image representation, segmentation, stereo, color, texture perception, motion, knowledge representation, and neural nets. *Recommended: CSC 436 or CSC 481.*

CSC 589  **Topics in Database.** Prerequisite: consent of the instructor. Independent study form required.

CSC 590  **Topics in User Interfaces.** Prerequisite: completion of the corresponding visual computing core sequence or consent of instructor. May be repeated for credit.

CSC 591  **Topics in Algorithms.** An in-depth discussion of one or more of the following topics: algorithms for integer operations, polynomial arithmetic including applications of the fast Fourier transform, matrix operations, pattern matching algorithms, proving lower bounds on the complexity of algorithms, parallel algorithms, approximation algorithms. *Prerequisite: CSC 491.*

CSC 592  **Topics in Computer Vision and Pattern Recognition.** Prerequisite: completion of the corresponding visual computing core sequence or consent of instructor. May be repeated for credit.

CSC 594  **Topics in Artificial Intelligence.** Prerequisite: CSC 480. Independent Study form required.

CSC 595  **Topics in Graphics.** Prerequisite: completion of the corresponding visual computing core sequence or consent of instructor. May be repeated for credit.

CSC 598  **Topics in Data Analysis.** Prerequisite: consent of instructor. Independent Study form required.

CSC 599  **Topics in Computer Science.** Prerequisite: consent of instructor. Independent Study form required.

CSC 610  **Computer Science 1.** An introduction to structured programming using PASCAL. Topics include: elementary data types, program control structures, character strings, array processing, procedures and functions, and an introduction to user-defined data types.

CSC 611  **Computer Science 2.** Conceptual models of a computer, machine and assembly language: internal data representation, programming methods, recursion. Basic data structures, stacks, queues, linked lists. Trees, tree searches and string processing. *Prerequisite: CSC 610.*

CSC 630  **Computers in Education.** An introduction to computers in education. A survey of software and hardware available for educational purposes. Hands-on experience with microcomputers. How to evaluate educational software.
CSC 640  **Teaching Computer Science.** A study of different programming languages used in high schools: PASCAL, BASIC, LOGO etc. A survey of computer topics covered in high school courses. Motivation and objectives in computer education. **Prerequisite:** CSC 611.

CSC 670  **Computer-Assisted Instruction.** Study and analysis of the use of the computer as an aid in instruction. Use of CAI languages such as PILOT. **Prerequisite:** CSC 630.

CSC 671  **Quantitative Computing Workshop.** Quantitative computing background needed for graduate study complemented with application to useful problems using appropriate software tools.

CSC 672  **Data Analysis Workshop.** Statistical background needed for graduate study complemented with experience in data analysis using SAS. **Prerequisite:** CSC 671 or equivalent.

CSC 680  **Programming with LOGO.** An introduction to LOGO, a powerful yet easy-to-learn language that both adults and children can use to express ideas.

CSC 690  **Research Seminar.** Readings and discussion on current research topics.

CSC 696  **Master's Project.** Four credit hours. Students may register for this course only after their advisor has approved a written proposal for their project. **Prerequisite:** consent of advisor. Independent study form required.

CSC 698  **Master's Thesis.** Two credit hours. Students may register for this course only after their advisor has approved a written proposal for their thesis. Students must continue to register for this course every quarter after their first registration in it until they complete their project or thesis to the satisfaction of their advisor. They earn two hours of credit for each such registration but only four hours of credit will apply for degree credit. **Prerequisite:** consent of advisor. Independent study form required.

CSC 699  **Research.** **Prerequisite:** One to 12 hours per quarter. A total of 12 hours is required. **Prerequisite:** Pass Candidacy Examination in three concentration areas.

CSC 701  **Resident Candidacy Continuation.** Non-credit. Students admitted to candidacy for the doctoral degree who have completed all course and dissertation registration requirements and who are regularly using the facilities of the University for study and research are required to be registered each quarter of the academic year until the dissertation and final examination have been completed. **Prerequisite:** Admission to Candidacy Independent Study form required.

CSC 702  **Non-Resident Candidacy Continuation.** Non-credit. This registration provides for doctoral candidates who have been admitted to candidacy who are not in residence and need only occasional use of University facilities, including the libraries. **Prerequisite:** Admission to Candidacy Independent Study form required

**DISTRIBUTED SYSTEMS COURSE OFFERINGS**

Completion of the Prerequisite Phase is required for all courses not listing specific prerequisites.

**DS 420  Foundations of Distributed Systems.** An examination of current software architectures (e.g., client/server), protocols (e.g., LDAP, OpenDoc, DCOM/ActiveX, CORBA), and tools (e.g., Java RMI) for distributed systems. Platform, performance, and concurrency issues. Overview of development tools. **Prerequisite:** Completion of all prerequisite courses.
DS 421  Distributed Systems Programming. An introduction to programming distributed systems, with emphasis on networking constructs such as sockets, remote procedure calls, and object request brokers. Naming and transaction services, events, persistence, and message passing. Small programming projects using a mix of languages and technologies. Prerequisite: CSC 225, CSC 416, CSC 314, DS 420.


DS 513  Client/Server Technologies. In-depth study of DCE technologies such as RPC and Kerberos that provide an infrastructure for distributed computing under the client/server model. Global directory services. N-tier client/server database systems. Integration of Web and database technologies through servlets, CGI, and related technologies. The course involves programming. Prerequisite: CSC 225, CSC 416, CSC 314, DS 420.

DS 520  Distributed Systems Practicum. Design and implementation of servers, with emphasis on active control technologies such as ActiveX and JavaBeans for n-tier client/server systems. Network-based software distribution. Distributed data access through LDAP, ODBC, and related technologies. Projects will be done in leading-edge languages and tools such as Visual Basic, Java, PowerBuilder, and Visual C++. Prerequisite: DS 420, SE 450. DS 421 is recommended.

DS 575  Intelligent Information Retrieval. Examination of the design, implementation, and evaluation of information retrieval systems. The focus is on the underlying retrieval models, algorithms, and system implementations. Also examined is how an effective information search and retrieval is interrelated with the organization and description of information to be retrieved. Topics include: automatic indexing, thesaurus generation, Boolean, vector-space, and probabilistic models; clustering and classification; information filtering; distributed IR on the WWW, intelligent information agents, IR system evaluation, information visualization, and natural language processing in IR. Throughout the course, current literature from the viewpoints of both research and practical retrieval technologies both on and off the World Wide Web will be examined. Prerequisite: CSC 415 and CSC 416 (CSC 311) or consent of Instructor.

DS 594  Distributed Systems Project. Design, justification, implementation, and performance analysis of a distributed system. Team-based projects that use a variety of tools are encouraged. Prerequisite: DS 520, SE 450.

DS 599  Topics in Distributed Systems. Prerequisite: consent of instructor. Independent Study form required.

E-COMMERCE TECHNOLOGY OFFERINGS

ECT 423  Internet Multimedia. Design and prototyping of multimedia applications for delivery via the Internet. Survey of low-bandwidth file formats for images, sound, and animation. Bandwidth reduction techniques and tools. Discussion of client side and server side allocation of responsibility. Authoring tools. Students will create and evaluate several small applications. Prerequisite: HCI 440 or ECT 441.
Prerequisite: ECT 555.

ECT 555  Design and Strategies for Internet Commerce. An integrated study of strategies, design, and technology issues for consumer oriented Electronic commerce. Mercantile models, mass customization, interactive marketing, search engines, and digital payment systems. Web engineering process, requirement analysis, design, usability testing, prototyping, implementation, promotion, and site evaluation. Team projects will develop commercial web sites using authoring tools and scripting. 
Prerequisite: ECT 410, IS 422, or HCI 430, or DS 420, or advanced standing for other majors.

Prerequisite: ECT 555.

Prerequisite: ECT 555.

Prerequisite: ECT 555.

ECT 583  Advanced Scripting Technologies. Advanced scripting technologies for e-commerce. Major topics include advanced database techniques with ASP, ASP server object, ASP server components, building ASP components, ASP and transacted Web applications, securing Web servers, working with Web servers, and scripting with Perl in non-Microsoft systems. Students will design and build an integrated online store with product catalog, shopping cart, checkout processing, order processing, secure Web server, and customer service. 
Prerequisite: ECT 410, ECT 555, and CSC 449.
ECT 584  **Web Data Mining for Business Intelligence.** An in-depth study of various aspects of data collection, data extraction, and knowledge discovery on the Web for e-business intelligence. The primary topics covered in the course are Web usage mining, Web content mining, and Web structure mining. Techniques and applications for mining e-commerce and Web usage data for site management, personalization, and user profiling. Also addressed are privacy issues, collaborative and content-based filtering. Techniques for harnessing semi-structured data through techniques based on text mining, and meta-data representation and manipulation using XML. **Prerequisite:** ECT 410, ECT 555, and CSC 449.

ECT 585  **Legal Aspects of E-Commerce.** This course is focused on how the law affects e-commerce. Topics include: electronic contracts, privacy issues associated with the use of the Internet, security issues including digital signatures, encryption and biometrics, intellectual property issues including trademark/domain name conflicts, copyrights, patents for business methods, taxation of internet transactions. Students will also gain an understanding of the issues involved in taking a company public (IPO), what information venture capitalists (VC) require in order to make decisions regarding financing startup companies. **Prerequisite:** ECT 555.

ECT 586  **Customer Relationship Management Technologies.** An in-depth study of customer relationship management (CRM) technologies and strategies. The special focus will be on e-business approaches and supporting technologies for managing the customer lifecycle across Internet and offline channels. Topics include customer identification, differentiation, interaction and customization techniques, sales force automation, call centers, field service and logistics, customer self-service, demand channel management, and customer segmentation. Students will compare specific CRM technologies and develop an Internet customer interaction application and an eCRM strategy in group project. **Prerequisite:** ECT 555.

ECT 589  **Electronic Commerce Management.** This capstone course is for ECT majors and students in IS/E-Commerce concentrations only. It is focused on the development of e-business strategies and management of related technology and organization resources. Conducted in the format of seminar, case analysis, and dialogue with industry practitioners, this course requires students to actively participate in the study of various models and approaches pertaining to e-business. Topics include: planning and development of digital strategies, enterprise transformation for supporting e-commerce, project management and web engineering methodology, e-business team development, sourcing and procurement for product and technology solutions for value chain integration. This course should be taken at the conclusion of the ECT program. **Prerequisite: Completion of all other required courses.**

ECT 596  **Topics in E-Commerce Technology.** Independent Study form required. **Prerequisite: consent of instructor.**

ECT 690  **Research Seminar.** Readings and discussion on current research topics. Students may register for this course no more than twice. **Prerequisite: consent of instructor.**
ECT 696  **Master’s Project.** Four credit hours. Students may register for this course only after their advisor has approved a written proposal for their project. Independent study form required. **Prerequisite: consent of advisor.**

ECT 698  **Master’s Thesis.** Two credit hours. Students may register for this course only after their advisor has approved a written proposal for their thesis. Students must continue to register for this course every quarter after their first registration in it until they complete their project or thesis to the satisfaction of their advisor. They earn two hours of credit for each such registration but only four hours of credit will apply for degree credit. **Prerequisite: consent of advisor. Independent study form required.**

**HUMAN-COMPUTER INTERACTION COURSE OFFERINGS**

Completion of the Prerequisite Phase is required for all courses not listing specific prerequisites.

**HCI 400**  Analysis and Design for HCI. Introduction to the relation between psychology and human-computer interaction. Understanding users and tasks in the context of the work environment. **Prerequisite: CSC 150, CSC 240, PSY 105.**

**HCI 422**  Multimedia. Multimedia interface design. Underlying technological issues including synchronization and coordination of multimedia, file formats for images, animations, sound and text. Hypertext. Information organization. Survey of multimedia authoring software. Long distance multimedia (World Wide Web). Students will critique existing applications and create several multimedia applications. **Prerequisite: CSC 416 or HCI 440.**

**HCI 430**  Prototyping for Human-Computer Interaction. Introduction to creating prototypes for HCI systems. Discusses modern user interface programming tools (VB, Access, etc.). The emphasis is on creating testable prototypes and evaluating these prototypes. Converting the prototype to a final working system is discussed. Students create a prototype for a predefined system, evaluate the prototype, redesign the system as necessary, and convert it to a final working system. Students prepare written documents describing their activities and present the final results to the class. **Prerequisite: HCI 440.**

**HCI 432**  User-Centered Interactive. Analysis, design, and development of interactive www sites. Evaluation of www interactions in terms of user-centered design and appropriateness of application. Use of commercially available development tools to exploit client-side technology. Production and preparation of multimedia elements for web distribution. **Prerequisite: HCI 430 and HCI 440.**

**HCI 440**  Introduction to Human-Computer Interaction. The user-interface development process. The user/task/work environment analysis. Low-fidelity prototyping techniques. User interface design principles. User interface styles including menus, command languages, form fill-in, direct manipulation and natural language. **Prerequisites: HCI 400 and HCI 440.**

**HCI 460**  Evaluating Human-Computer Interaction. Techniques of heuristic evaluation, usability testing and formal experimentation. Students take a prototype interface from a first implementation through evaluation. **Prerequisite: HCI 440.**

**HCI 470**  Digital Page Formatting I. Problem-based applications of perceptual and communication principles to the presentation of on-line and off-screen pages. Includes experience with industry standard vector, raster and formatting software. **Prerequisite: HCI 402, ART 105, or equivalent.**
HCI 471  Digital Page Formatting II. Client-based applications for formatting in multi-page screen environments. Includes experience with industry standard multimedia software. Prerequisite: HCI 470.

HCI 511  Designing for Disabilities. Designing computer-based solutions for problems faced by people with disabilities. Designing for both physical and cognitive disabilities. Solutions include text enlargement, enhanced audio, custom presentation of information, and unique input devices. Prerequisites: HCI 440 and HCI 460.

HCI 512  Designing for Visualization. Sources of graphical integrity and sophistication. Data-ink maximization. Data density. Color and information. Effective use of space and time. Prerequisites: HCI 440 and HCI 460.

HCI 513  Design and Strategies for Internet Commerce. An integrated study of design, technical and strategic issues for Internet commerce. Competitive strategies for consumer Internet commerce, extranets, and intranets. Supply chain management, mass customization, interactive marketing, corporate digital library, and mercantile models. Web analysis, design, prototyping, implementation, and evaluation. Visual, textual, and context organization, response time, usability testing. Authoring tools and administering web servers, Internet database servicing and architecture issues, Internet service providers and pricing, Digital payment and encryption. Team projects will develop commercial web sites. Prerequisite: HCI 440.

HCI 540  User Interface Implementation I. Converting prototypes into running systems. The focus is on using a User Interface Management System, learning the underlying programming language, and the underlying programming environment. Students work on a project that requires pushing the UIMS beyond its normal limits: TUI+, Galaxy, DevGuide, C, C++, Tcl/Tk. Students present their final results to the class. Prerequisite: CSC 417 or HCI 430.

HCI 560  Information Technology Training and User Support. Designing and delivering information technology training in the workplace, both instructor-led and computer-based. Theories of adult learning, preparing, presenting, and evaluating courses. Training management systems, Performance support systems and job aids. Prerequisite: HCI 440 and HCI 460.

HCI 590  Topics in Human-Computer Interaction. Prerequisite: completion of the HCI core courses or consent of the instructor. May be repeated for credit.

HCI 594  Human-Computer Interaction Capstone. HCI 594 provides an opportunity for students to apply all of the skills they have learned on one comprehensive project. Multidisciplinary teams design, evaluate, and implement a user interface intensive project. Students prepare written documents describing their activities and present the final results to the class. Prerequisite: completion of the HCI core courses.

INFORMATION SYSTEMS COURSE OFFERINGS
Completion of the Prerequisite Phase is required for all courses not listing specific prerequisites.
IS 421  Information Systems Analysis. Introduction to the systems analysis phase of the software development life cycle. Emphasizes feasibility analysis, information gathering, process modeling, data modeling, and requirements definition. Topics and team project tasks include CASE tools, RAD, IAD, work flow diagrams, entity-relationship diagrams, data flow diagrams, and object oriented modeling. Students are strongly urged to take IS 421 and 422 in consecutive quarters. Prerequisite: IS 404 and either CSC 310 or CSC 336.

IS 422  Information System Design. Introduction to the system design and implementation phases of the software development life cycle. Emphasizes techniques for developing a logical and physical design from a systems analysis. Topics and team project tasks include CASE tools, object oriented modeling, structure charts, action diagrams, interface design, prototyping, testing, implementation, and maintenance. Students are strongly urged to take IS 421 and 422 in consecutive quarters. Prerequisite: IS 421.

IS 450  Technological Organizational. A study of the methods and management of technology-triggered business process transformation. Moving organizations from traditional chain-of-command to flexible technology-enabled collaborative networks. Designing and implementing a change management plan. Eliciting user participation, cooperation and support for IT projects. Includes consideration of procedures development, user training, steps in the dissemination of a new technology throughout an organization, and the roles of organizational culture, a technology champion, and top management. Prerequisite: IS 483 or HCI 400 or ECT 555.

IS 482  Legal Aspects of Information Technology. A practical survey of computer law arising in a high-tech environment. Topics covered include: employment contracts, civil and criminal laws, fraud and abuse, contracts, e-commerce, intellectual property, privacy, security, harmful communications, constitutional and first amendment issues, and international law and trade. Prerequisite: IS 421.

IS 483  Information Systems Management. Concepts, tools and techniques for managing information systems operations and services. Topics include organizational information service functions; IT human resources management; capital and operating budgets; procurement of hardware, software and vendor services; preparation of RFPs and contracts; user training and service agreement, help desk support; project management and team development; and performance benchmarking. Prerequisite: IS 421.

IS 511  Social Issues of Computing This course aims to provide a broad survey of the individual, organizational, and cultural impacts of computers and to stimulate reflection upon the social and ethical issues provoked by current and projected uses of computers. Topics include an in-depth look at computers as they relate to the workplace, communities, public policy, legal issues, education, privacy, and moral values. Prerequisite: IS 404 and IS 483.
IS 512  
**Groupware and Virtual Collaboration.** Study of the development and use of computer technologies to support local and distributed group collaboration including virtual teaming. This course will survey the emerging IS fields of groupware, computer-supported cooperative work (CSCW), and group support systems (GSS). Students will acquire an understanding of both the architectural issues of designing and implementing these technologies as well as group, organizational and societal implication of their use. **Prerequisite:** IS 422 or DS 420 or equivalents.

IS 540  
**Global Information Technology.** A study of the practice and management of information technology in a global environment. Management, development and deployment of multinational interorganizational information systems. Multinational strategic alliances, including multinational interorganizational information systems. Transborder data flow. Geographic and cultural issues. Economic considerations, including exchange rates and labor supply. Integration of diverse technologies. **Prerequisite:** IS 483 or ECT 555 or consent of instructor.

IS 549  
**Data Warehousing and Data Mining.** Introduction to data warehousing and the foundations of building a successful data warehouse. Data warehouses development methodology and issues surrounding the planning of the data warehouse. Data quality and metadata in the data warehouse. Analysis, transformation and loading of data into a data warehouse. Development of the data architecture and physical design. Implementation and administration of the data warehouse. **Prerequisite:** CSC 449.

IS 553  
**Advanced Topics for System Development.** Planning and implementation of enterprise systems in the context of enterprise transformation and new market dynamics. Networked enterprise and virtual organizations. Internet and Intranet applications for electronic commerce, mass customization and information empowerment. Enterprise-wide systems, business process reengineering, interorganizational systems, sourcing options, and transformational information technologies. Value-chain analysis and competitive strategies. Case studies examine various planning and implementation approaches and impacts. **Prerequisite:** IS 422.

IS 554  
**Information Engineering.** Application of structured techniques on enterprise-wide data models, information architecture, and cross-functional models. Stages for information strategy planning, business area analysis, joint requirement planning, and I.E. methodology. CASE tools, organizational strategies and economics of financial justification. Case studies. **Prerequisite:** IS 422 and CSC 449.
**IS 555 Design and Strategies for Internet Commerce.** An integrated study of design, technical, and strategic issues for Internet commerce. Competitive strategies for consumer Internet commerce, extranets, and intranets. Supply chain management, mass customization, interactive marketing, corporate digital library, and mercantile models. Web analysis, design, prototyping, implementation, and evaluation. Visual, textual, and content organization, response time, usability testing. Authoring tools and administering web server. Internet database serving and architecture issues. Internet service providers and pricing. Digital payment and encryption. Team projects will develop commercial web sites. **Prerequisite:** IS 422 or HCI 430 or DS 420, or advanced standing for other majors.

**IS 556 Project Management.** Project leadership from a managerial perspective. Emphasis on organizational factors, including team building, overcoming resistance to technological change, and project risk management. Consideration of the impact of corporate culture, and the role of the user. External factors, including vendor relationships, proposals, and contracts. Project structuring, tools and techniques for project estimating and scheduling, control mechanisms, including project management software. methods for continuous project assessment; consideration of projects of all sized and approaches, including traditional life cycle and rapid development. **Prerequisite:** IS 422 or ECT 555.

**IS 560 Enterprise Resource Planning.** Planning and implementation of enterprise systems in the context of enterprise resource planning (ERP). This course will examine the client server architecture, tools, and functionality of leading enterprise systems. The ERP process encompasses the life cycle and methodologies for process and systems integration, including system selection, scoping and planning, project teams and sponsorship, change management, process reengineering, data and systems conversion, testing, user training, and post implementation strategies. **Prerequisite:** IS 422 and IS 483 or consent of instructor.

**IS 574 Decision Support Systems and Executive Information Systems.** Understanding of software support for organizational decision making. Analysis, design and implementation of systems for decision support and strategic planning, including decision support systems (DSS), group discussion support systems (GDSS), and executive information systems (EIS). Case studies, projects on applications, and evaluation of software. **Prerequisite:** IS 422 and CSC 449.

**IS 575 Information Retrieval.** Examination of the design, implementation, and evaluation of information retrieval systems. The focus is on the underlying retrieval models, algorithms, and system implementations. Also examined is how an effective information search and retrieval is interrelated with the organization and description of information to be retrieved. Topics include: automatic indexing, thesaurus generation, Boolean, vector-space, and probabilistic models; clustering and classification; information filtering; distributed IR on the WWW; intelligent information agents; IR system evaluation, information visualization, and natural language processing in IR. Throughout the course, current literature from the viewpoints of both research and practical retrieval technologies both on and off the World Wide Web will be examined. **Prerequisite:** CSC 415 and CSC 416 (CSC 311) or consent of instructor.
IS 577  Information Technology Policies and Strategies. This capstone course emphasizes the management of information technology and related resources from a broad strategic perspective. Topics covered include assessment of information technologies and their fit to organizational structure, tracking emerging technologies and trends, managing portfolio resources and matching them to business needs, technology transfer, end-user computing, outsourcing, theoretical models, strategic applications and strategic IT planning. Students are encouraged to take this course toward the end of their study. **Prerequisite: Completion of the IS Core Knowledge Phase.**

IS 578  Information Technology Consulting. Models, techniques, and skill development for providing effective IT consulting services. Emphasis will be on the structure of the IT consulting markets, leading consulting practices, models and approaches for internal consulting services, sourcing strategies, evaluation of RFPs and response process, contract formulation and negotiation, account management, client relations and project management, knowledge management, collaboration, and IT strategies. **Prerequisite: IS 483 or ECT 593 or consent of instructor.**

IS 596  Topics in Information Systems. **Prerequisite: consent of instructor. Independent Study form required.**

IS 690  Research Seminar. Readings and discussion on current research topics. Students may register for this course no more than twice. **Prerequisite: consent of the instructor.**

IS 696  Master's Project. Four credit hours. Students may register for this course only after their advisor has approved a written proposal for their project. **Prerequisite: consent of advisor. Independent study form required.**

IS 698  Master's Thesis. Two credit hours. Students may register for this course only after their advisor has approved a written proposal for their thesis. Students must continue to register for this course every quarter after their first registration in it until they complete their project or thesis to the satisfaction of their advisor. They earn two hours of credit for each such registration but only four hours of credit will apply for degree credit. **Prerequisite: consent of advisor. Independent study form required.**

SOFTWARE ENGINEERING COURSE OFFERINGS

**Completion of the Prerequisite Phase is required for all courses not listing specific prerequisites.**

SE 420  Object-Oriented Design. Techniques and guidelines for designing large-scale software systems in C++ that aim to create highly maintainable, and highly testable software architectures. Techniques discussed include: logical and physical organization and levelization, incrementations of classes. Using templates and C++ Standard Templates Library. **Prerequisite: CSC 225 or CSC 310.**

SE 427  Software Quality Management. Quality management principles, tools, and methods applied to the software developmental process. Selected techniques for continuous and incremental improvements in product and process such as defect analysis, control charts, risk assessment, quality control, quality improvement programs, quality function deployment, the capability maturity model, cleanroom engineering, and benchmarking. **Prerequisite: CSC 323 or consent.**
COURSE DESCRIPTIONS

SE 430  **Object-Oriented Modeling.** Object-oriented modeling techniques for analysis and design. Emphasis on one approach and a survey of several alternative approaches, for example, Codd and Yourdon, Booch, Rumbaugh, and Shlaer and Mellor. Relationship between these modeling techniques and the features of object-oriented languages including C++. Team project **Prerequisite:** CSC 225 or CSC 310.

SE 431  **Formal Software Specifications and Development I.** This course will focus on practical applications of formal software specification and design techniques. Topics include a survey of formal specification approaches and languages, model-oriented specifications, design refinement, and supporting tools for formal software development. **Prerequisite:** CSC 415.

SE 433  **Software Testing.** Software testing strategies. Designing test plans and test cases. Design reviews, walk throughs, and inspections. Configuration management. **Prerequisite:** CSC 416.

SE 450  **Object-Oriented Software Development.** Fundamentals of object-oriented programming using Java. Principles and techniques of applying object-oriented analysis, design, patterns, and frameworks. **Prerequisite:** CSC 416.

SE 452  **Object-Oriented Enterprise Application Development.** This course focuses on applying object-oriented techniques in the design and development of software systems for enterprise applications. Topics include component architecture, such as Java Beans and Enterprise Java Beans, GUI components, such as Swing, database connectivity and object repositories, server application integration using technologies such as servlets, Java Server Pages, JDBC and RMI, security and internationalization. **Prerequisite:** CSC 314 or SE 450.

SE 455  **Software Development Methods.** Techniques for designing, implementing and testing large-scale software systems, as well as principles and methods for developing high quality software systems. Object-oriented technology and its application. Topics include: object-oriented design methods and notations, object-oriented programming and testing, formal specifications, and programming methodologies. **Prerequisite:** CSC 417 and (CSC 447 or SE 430 or SE 450).

SE 465  **Software Engineering Principles.** Survey of fundamental concepts and principles in software engineering. Requirements analysis and software specification, requirements validation and prototyping, and formal specifications. Software design, Software testing, Software project measurements and management. Social issues and ethics. Students will work on team projects. **Prerequisite:** CSC 225 or CSC 310.

SE 466  **Software Engineering Projects.** Emphasize on team work, application of development and management techniques and use of CASE tools. The projects involve requirements analysis, requirements validation and inspection, object-oriented design, implementation, testing, integration, demonstration, and presentation. **Prerequisite:** SE 430 or consent.

SE 467  **Software Reliability.** The practical application and theory of software reliability models. Classification and comparison of software reliability models. Parametric estimation. **Prerequisites:** CSC 323 or consent.

SE 468  **Software Measurement and Project Estimation.** Software metrics. Productivity, effort and defect models. Software cost estimation. **Prerequisites:** CSC 423 and either SE 430 or CSC 315 or consent.
SE 469  **Software Safety.** Managing safety, the safety process, hazard analysis models and techniques, designing for safety, verification of safety. **Prerequisite:** SE 430 or consent.

SE 477  **Software and Systems Project Management.** Planning, controlling, organizing, staffing and directing software development activities or information systems projects. Theories, techniques and tools for scheduling, feasibility study, cost-benefit analysis. Measurement and evaluation of quality and productivity. **Prerequisite:** SE 465 or CSC 315.

SE 480  **Software Architecture.** Software architecture is a critical aspect of complex software systems. A system's architectural design is concerned with describing its decomposition into computational elements and their interactions. Architectural design tasks involve system decomposition, global control structures, protocols for communication, synchronization, data access, physical distribution of components, performance tuning, defining evolution paths, and selecting design alternatives. Major issues addressed include: architectural description, formal underpinnings, design guidance, domain-specific architecture, tools and environments. **Prerequisite:** SE 455.

SE 491  **Software Engineering Studio.** Students will work in small teams to develop realistic software systems in a master-apprentice environment. The instructor will serve as a master/mentor/project leader. Students will apply knowledge and skills they have learned in previous course in solving real world problems. The projects may last more than a quarter. Students must register for SE 692 Software Engineering Studio Continuation in each subsequent quarter. **Prerequisite:** SE 450 or SE 455.

SE 529  **Software Risk Management.** Identification, estimation, evaluation, planning, controlling, and monitoring of risk involved in the development, maintenance, operation and evolution of systems. **Prerequisites:** (CSC 323 and SE 430) or consent.

SE 531  **Formal Software Specifications and Development II.** Techniques for specifying software requirements using formal language. Model-based and algebraic formal specifications. Cleanroom software development. Application of formal methods in real software development projects. **Prerequisites:** SE 431.

SE 533  **Software Validation and Verification.** Techniques, methods and tools for software inspection and testing. Theory and applications of formal verification of programs. Techniques and tools for automated analysis of programs. **Prerequisite:** SE 450.

SE 540  **Software Development for Mobile and Embedded Systems.** This course will focus on the unique aspects, tools, and techniques of developing software applications for mobile and embedded systems, such as set-top boxes, hand-held computers, and personal digital assistant (PDA) devices. Topics include embedded operating systems, such as PalmOS, and object-oriented development of embedded applications such as applications using WAP and applications for PDAs and smart cards. **Prerequisite:** SE 450 and CSC 416.

SE 552  *Concurrent Software Development.* Fundamentals and techniques of developing concurrent object-oriented applications, using a patterns-based approach. Concepts covered include: threads, synchronization and object locking, thread blocking and deadlock, safety and liveness, state-dependent action and concurrency control. **Prerequisite:** SE 450 and CSC 416.

SE 558  *Software Methodologies.* Recently developed techniques for software requirements analysis, specification, and design. **Prerequisite:** SE 430 or consent.

SE 560  *Structured Document Interchange.* Document and data interchange among different applications is an extremely important aspect of software application development. This course will focus on emerging technologies associated with the Extensible Markup Language (XML), such as the Document Object Model (DOM), the Simple API for XML (SAX), the XML Stylesheet Language (XSL), and XSL Transformation Language (XSLT), and XML Schema. Applications of these technologies will be discussed in conjunction with tools and techniques for parsing, transforming, and manipulating documents. **Prerequisite:** SE 450 and CSC 416.

SE 571  *Software Maintenance.* Maintenance characteristics, tasks, side effects, issues and techniques. Management considerations. Productivity in the maintenance environment. Structured technologies and maintenance. **Prerequisite:** SE 430 or consent.

SE 590  *Advanced topics in Object Oriented Technology.* **Prerequisite:** consent of instructor.

SE 591  *Software Engineering Studio II.* This is the continuation of SE 491. SE 491 and 591 must be taken as a sequence in two consecutive quarters. **Prerequisite:** SE 491.

SE 690  *Research Seminar.* Readings and discussion on current research topics. Students may register for this course no more than three times. **Prerequisite:** consent of the instructor.

SE 696  *Master's Project.* Four credit hours. Students may register for this course only after their advisor has approved a written proposal for their project. **Prerequisite:** consent of advisor. Independent study form required.

SE 698  *Master's Thesis.* Four credit hours. Students may register for this course only after their advisor has approved a written proposal for their thesis. **Prerequisite:** consent of advisor. Independent study form required.

SE 699  *Software Engineering Research Continuation (1 credit hour).* Students register for continuation credit after registering for SE 698 in each subsequent quarter until they complete their thesis. Students who fail to do so will have to re-register for SE 698 to meet the requirement for completing that course. **Prerequisite:** SE 698.

**TELECOMMUNICATIONS AND DATA COMMUNICATIONS COURSE OFFERINGS**

Completion of the Prerequisite Phase is required for all courses not listing specific prerequisites.

TDC 411  *Computers in Information Systems and Telecommunications.* An introduction to computer organizations and operating systems. Computer components and functions, logic circuits, internal processing, multiprogramming, timesharing, memory management, file management, interrupts and I/O peripheral devices. **Prerequisite:** CSC 215 and PHY 405.
TDC 452  *Computer and Information Systems Modeling.* Simulation, analytic modeling, and measurement of computer and information systems. Operational analysis. Introduction to queuing theory. **Prerequisites:** CSC 416, MAT 145, TDC 463.

TDC 461  *Basic Communication Systems.* A history of telecommunications and regulatory and regulatory agencies. The basic communication model and its application to different communication systems, communication models. The telephone architecture, a typical data communication system, common carrier services, mediums and their characteristics. **Prerequisites:** PHY 405 and TDC 411 are recommended.

TDC 462  *Data Communications.* Theory and components of data communication systems, modes, codes, and error detection techniques for data transmission, network protocols and line control procedures, communication carrier facilities and system planning. **Prerequisite:** CSC 415 and either CSC 345 or TDC 411.

TDC 463  *Computer Networks and Data Systems.* A detailed discussion of the seven layers of the ISO reference model. The design of interfaces and protocols. Network protocol organization will be discussed using TCP/IP and OSI protocols as examples. **Prerequisite:** TDC 411 or CSC 343.


TDC 476  *Economics of Telecommunication Systems.* Inventory concepts, asset amortization. Liabilities. Consolidated statements, cost accounting, capital budgeting, investment decisions. **Prerequisite:** TDC 425 or TDC 461.

TDC 489  *Queuing Theory with Computer Applications.* An overview of queuing theory. Queuing systems, related random processes, classification of queues. Priority queuing. Computer time sharing and multi-access systems. **Prerequisite:** TDC 432 or consent.

TDC 511  *Telecommunications Practicum.* Introduction to the functionality and management of voice and data communications equipment in the Telecommunications and Local Area Networks laboratories. Emphasis will be on practical understanding and experience through laboratory exercises. **Prerequisite:** TDC 461, TDC 462 and TDC 463.

TDC 512  *Cellular and Wireless Telecommunications.* An overview of cellular telephony including regulatory framework, RF design and frequency reuse, signaling and microwave interconnection issues. Personal Communications Systems (PCS), mobile radio, satellite and paging systems will also be considered. **Prerequisite:** TDC 464.

TDC 513  *Client/Server Technologies.* A study of DCE technologies that provide an infrastructure for distributed computing under the client/server model. RPC, Kerberos, global and cell directory services, threads. Programming and administrative issues. This course involves programming. **Prerequisites:** TDC 561.
TDC 514  **Computer Telephony.** A study of enabling technologies allowing the integration of voice communications services with personal computers, LANs and mainframes. Telephony programming interfaces, call management software, intelligent fax/data retrieval and interactive voice response systems will be considered. **Prerequisites:** TDC 463 and TDC 464.

TDC 561  **Network Programming.** A high-level understanding of network architectures and distributed applications, client/server models, remote procedure call; examples of applications such as electronic mail and file transfer; network programming. **Prerequisite:** TDC 463, CSC 416.

TDC 562  **Computer-Communication Network Design and Analysis.** Quantitative approaches to the design of data communications networks. Practical examples of networks. Statistical multiplexing and buffering at communication concentrators. Topics in overall network design. **Prerequisites:** TDC 432, TDC 462, or consent.

TDC 563  **Protocols and Techniques for Data Networks.** Packet communications: transport protocols, terminal, file transfer, and remote job protocols; packet broadcast protocols; security, database management in distributed networks. **Prerequisite:** TDC 463 or consent.

TDC 564  **Local Area Networks.** A detailed discussion of the current standards and technology. Medium access techniques, topologies, network operating systems, applications, and an introduction to several commercial and research networks. **Prerequisite:** TDC 425 or both TDC 462 and TDC 463.

TDC 565  **Voice and Data Integration.** Methods for data transmission and switching over Wide Area Network telecommunications facilities. DDS and T1 networking. Alternate voice digitization techniques. Microwave, satellite and fiber optic transmission systems. Structure and evolution of the digital telecommunications network. **Prerequisites:** TDC 462 and TDC 464.

TDC 566  **Integrated Services Digital Networks.** A study of the Integrated Services Digital Network (ISDN) including its structure, services and protocols. How current network switching and transmission methods must be modified and expanded to allow integration of voice and data services. A survey of current LEC and IXC ISDN offerings. Future trends in integrated communication networks. **Prerequisites:** TDC 463 and TDC 464.

TDC 567  **Telecommunication Systems Design and Management.** The theory and practice of Telecommunication system design. Ongoing systems management. Telecommunication management including selection of vendors/systems, structuring an RFP systems proposal analysis, computer aided telecommunications management. Telecommunication management strategies from the business perspective. **Prerequisite:** TDC 425 or TDC 461.

TDC 568  **Network Management.** Data network management systems. Fault, accounting, configuration, performance and security management using SNMP and other protocols. **Prerequisite:** TDC 462 and TDC 463. TDC 561 is recommended.

TDC 572  **Network Security.** Computer communications system security issues, including private and public key encryption and key distribution, challenge and authorization protocols, and password management issues. Security issues in file transfer and sharing, electronic mail, and network management applications. **Prerequisite:** TDC 425 or TDC 463.

TDC 573  **Multimedia Networking.** This course addresses the concepts, architecture and design of networked multimedia systems. Key issues in designing networked multimedia systems are discussed, including reliable multi-point communication/IP multicasting, media coding and compression, audio/video streaming, audio/video transmission, media synchronization, multimedia traffic demands and requirements, congestion control and scheduling. **Prerequisite:** TDC 561 or consent of instructor.

TDC 593  **Topics in Telecommunications.** Prerequisite: consent of instructor. Independent study form required.

TDC 597  **Topics in Data Communications.** Prerequisite: consent of instructor. Independent study form required.

TDC 690  **Research Seminar.** Readings and discussion on current research topics. Students may register for this course no more than twice. **Prerequisite:** consent of the instructor.

TDC 696  **Master's Project.** Four credit hours. Students may register for this course only after their advisor has approved a written proposal for their project. **Prerequisite:** consent of advisor. Independent study form required.

TDC 698  **Master's Thesis.** Two credit hours. Students may register for this course only after their advisor has approved a written proposal for their thesis. Students must continue to register for this course every quarter after their first registration in it until they complete their project or thesis to the satisfaction of their advisor. They earn two hours of credit for each such registration but only four hours of credit will apply for degree credit. **Prerequisite:** consent of advisor. Independent study form required.

INSTITUTE FOR PROFESSIONAL DEVELOPMENT OFFERINGS

Application and registration information for the following programs may be obtained by calling the Institute office at 912-362-6282. Students should consult with their advisor prior to registering for an IPD program to determine how it may apply to their degree program.

**IPD 383  Visual C++ Program.** An eleven-week accelerated program covering object-oriented Windows 95 software development using Visual C++. Program offered through the Institute for Professional Development; enrollment is restricted.

**IPD 384  Windows Software Development Program.** An eleven-week intensive certificate program in the fundamentals of MS Windows and client/server technology for programmers. Program offered through the Institute for Professional Development; enrollment is restricted.

**IPD 385  Web Developer Program.** A ten-week in-depth program covering the technologies and techniques of Web development for systems professionals. Program offered through the Institute for Professional Development; enrollment is restricted.

**IPD 386  Web Designer Program.** A ten-week intensive program covering the technologies and techniques of Web design and production. Program offered through the Institute for Professional Development; enrollment is restricted.
COURSE DESCRIPTIONS

IPD 387  Web Commerce Program. A ten-week comprehensive program covering the emerging E-Commerce technologies and strategies. Program is offered through the Institute for Professional Development; enrollment is restricted.

IPD 392  Telecommunications Program. A twelve-week integrated certificate program in telecommunications technology, systems and management. Program offered through the Institute for Professional Development; enrollment is restricted.

IPD 393  Local Area Networks Program. A ten-week intensive certificate program in the fundamentals of local area networks, wide area networks and data communications for LAN managers and data processing professionals. Program offered through the Institute for Professional Development; enrollment is restricted.

IPD 397  Computer Career Program. A thirty-week accelerated certificate program designed for those considering a change into the computer field. Program offered through the Institute for Professional Development; enrollment is restricted.

COURSES FROM OTHER DEPARTMENTS

ART 405  Advanced Color Design.

ART 461  Graphic Design II. Further explores ideas, processes, tools, and materials involved in the field. Real client contact is established to develop projects including business cards, letterhead, envelopes, brochures, ads, mailers, and posters. Prerequisite: ART 260.

ART 462  Publication Design. Focuses on introduction to design on various methods and visual approaches used to create attractive and easy to read publications: combination of concepts, aesthetics, and presentation techniques to create layouts for magazines, catalogs, and annual reports. Prerequisite: ART 461.

MAT 458  Statistical Quality Control. Consult the Department of Mathematics section of the Graduate Programs Bulletin for the description of this course.

PSY 402  Perceptual Processes. Analysis of the variable involved in the determination of perception with particular attention to the problems of space, motion, distance, size, form, the aftereffects and the constancies. Prerequisite: consent of instructor.

PSY 404  Learning and Cognitive Processes. Survey of classical and instrumental conditioning, biological constraints, attention, memory and practical applications. Major theoretical approaches include stimulus-response, early cognitive theories and information processing theory. Prerequisite: consent of instructor.

PSY 440  Psychology of Work and Motivation. Current research and theories in organizational psychology relating to motivation, job satisfaction, work attitudes, employee withdrawal, and counterproductivity. Prerequisite: consent of instructor.

PSY 441  Psychology of Leadership. Current research and theories in organizational psychology relating to leadership, supervision, job performance, and managerial training. Emphasis is on theoretical development and empirical evaluation of constructs in contemporary research. Prerequisite: consent of instructor.

PSY 443  Psychology of Human Performance (crosslisted with PSY 383). Application of experimental psychology and individual differences to the design of man-machine systems, work environments, and living environments. Prerequisite: PSY 680 or consent of instructor.
PSY 446  Psychological Theories of Organizations. Theory and research in the psychology of organizational design, analysis, systems, processes and change. Prerequisite: consent of instructor.

PSY 447  Organizational Consultation. Applies behavioral science and managerial theories and methodologies to organizational consultation and change processes. Prerequisite: consent of instructor.

PSY 680  Industrial and Organizational Psychology. Application of theories and methods of psychology to the study of human behavior in business, industry and other organizations. Prerequisites: PSY 105 or PSY 106.

Courses Related to the MIS Degree

GSB 499  Effective Communication. The introductory course for the Kellstadt Graduate School of Business draws on factors that make DePaul University distinctive: its Vincentian values, pragmatism and strong relationship with the Chicago business community. The course gives students the opportunity to develop knowledge and skills in communication necessary to effectively influence business and social decision-making. Students are encouraged to examine their personal role in the corporate environment through self-management, and forming and maintaining business relationships. The course examines the dynamics of communication in interpersonal transactions and in decision-making for business and society while exposing the student to specific skills necessary for success in DePaul’s graduate programs and today’s challenging global business environment. Prerequisite: graduate standing.

BLW 500  Legal and Ethical Environment. This is an introduction to the nature and sources of law, including an analysis of ethical perspectives present in the judicial process. Students will learn how legal and ethical issues influence the decision-making process of managers. Students will examine utilitarianism, the rights and justice perspective, and professional obligations as they are represented in the law. Students will explore the relationship between personal values and business decisions, and whether there exists a social responsibility of managers. This course will cover legal concepts relevant to business including basic concepts of public law (constitutional and administrative law) and private laws (sales and product liability). Students will examine business organizations and issues in employment law. Prerequisite: graduate standing.

ECO 500  Money and Banking. This course examines the role of money in the economy from both a functional and macroeconomic perspective. The role of the Federal Reserve as a monetary policy-maker will be examined in detail. Students completing this course will be able to make informed judgments of the impact of monetary and fiscal policy on inflation, interest and exchange rates, and the general level of economic activity. Prerequisite: mathematics workshop, or equivalent.

ECO 509  Business Conditions Analysis. This course teaches students how to use available economic data to assess business conditions. This is done by: (1) evaluating the sources and usefulness of data periodically released by government and private sources and (2) developing a macro-economic framework that the student can use to analyze business conditions. Completion of this course will allow students to understand economic news and relate it to their business or job. Prerequisites: mathematics and statistics workshops, or equivalent.
FIN 500 Financial Institutions and Markets. This course covers the structure and functions of the most important financial institutions and financial markets. Coverage includes the banking system, savings institutions, other financial institutions, money markets, capital markets, and markets for derivative securities. **Prerequisite: mathematics workshop, or equivalent.**

IB 500 Global Economy. This course is designed to be an introduction to the economic environment in which businesses operate. With the increasing interdependence of national economies and the growing role of global enterprises, the understanding of international economic issues is vital to decision-makers. The material covered will include both socio-cultural aspects and economic and financial dimensions of global business. Students should obtain a grasp of the basic theory as well as a knowledge of the major current issues in the global economy. **Prerequisite: graduate standing.**

Accounting

500 Financial Accounting. This introduction to financial accounting provides both a theoretical foundation and an opportunity to apply accounting logic in increasingly complex situations. The accounting model and information processing cycle are developed. The content of the Income statement, balance sheet, and statement of cash flows are studied in detail and analyzed. **Prerequisite: graduate standing.**

526 Microcomputer Uses in Decision-Making. Hands-on use of microcomputers as tools for solving business problems. Students will learn to apply existing software and to construct their own worksheets. Emphasis will be on problem formulation, input preparation and solution analysis. Problems are selected from areas such as allocation of scarce resources, capital budgeting, inventory planning and control, pricing and performance evaluation. Offered Autumn, Spring. **Prerequisites: basic knowledge of Lotus 1-2-3, GSB 502 and either ACC 542A or GSB 511 and permission of instructor.**

527 Design and Construction of Decision Models. This course covers the art of decision model construction and the application of existing decision models to managerial planning, control and decision-making. Existing models covered include linear programming and sensitivity analysis, learning curves, correlation analysis, inventory control models, PERT and CPM. Students will learn to apply probability and utility theory to decision-making under uncertainty, as well as to apply the concepts of game theory to conflict situations in a business setting. If time permits, the application of Markov processes and simulation to managerial planning and decision situations will be covered. Extensive microcomputer applications will be used in this course. Offered variably. **Prerequisite: Completion of Phase I or equivalent.**

535 Accounting Systems. Today's business person requires a fundamental knowledge of computer-based information systems and their role in accounting functions and financial decision-making. This course will enable the student to interface with accounting systems, to participate in their design and audit, and to use microcomputers effectively in financial planning, control and analysis. Topics include: advance data processing concepts, computer security and controls, systems analysis, design and implementation, hardware/software evaluation and selection, database systems, data communications, and office automation. Students will gain substantial hands-on experience on microcomputers using Lotus 1-2-3 and Lotus Symphony.
 COURSE DESCRIPTIONS

588 Management Consulting in the Accounting Profession. This course provides an overview of the scope and practice of management consulting and management advisory services (MAS) in the accounting profession. The process of management consulting is examined including: problem identification, proposal development, fact-finding, solution analysis and implementation of recommendations. Case studies will be used in the course to demonstrate the process of management consulting in various areas. The course reviews the professional standards and ethics of management consulting practice. In addition, the course includes the marketing and engagement management aspects of management consulting. Offered: variably. Prerequisite: completion of Phase I or equivalent.

Management Information Systems

674 Systems Analysis and Design: Concepts, Tools and Techniques. This course is designed as the first of two courses. It focuses on the early phases of the information systems development life cycle and covers primarily process-oriented techniques, methods and methodologies. This course prepares students for the case study-oriented MIS 676 course where learned techniques are applied. Laboratory exercises include the use of a computer-aided software engineering (CASE) tool. Offered Autumn, Winter, Summer. Prerequisites: completion of Phase I and MIS 670 or equivalent.

675 Advanced Systems Techniques. This course assumes a familiarity with basic systems techniques and tools such as data gathering, recording and analysis, flow charting, decision tables, system implementation, etc. Topics to be covered include systems concepts and philosophy, project management, advanced tools of systems analysis and design, the human element in systems, and the like. Prerequisite: MIS 676 or equivalent or permission.

676 Management Information Systems: Planning, Design and Implementation. The second of a two-course sequence for MIS majors. It summarizes and extends the concepts of functionally oriented, structured, and data-oriented methodologies and CASE tools and focuses on applying them. It covers other topics of interest to the systems developers and systems manager, such as: methodologies for systems development without programmers (prototyping, 4th generation languages, end user computing), management of information services including information center concepts, and analysis and design of decision support and expert systems. Offered Winter, Spring. Prerequisites: MIS 671 and MIS 674 or equivalent.

677 Information Systems Project Management. Projects are often late, over-budget, technically inoperable, operationally infeasible, and in some cases never finished. One of the roots of this problem has been the lack of experienced management. What is needed are appropriate managerial procedures of planning, scheduling and control that are responsive to the needs of the environment. This course will define the essential components of good project management. Although the emphasis will be on management of systems and data processing projects, the concepts and techniques presented will be general enough to be of value of those involved with the design and implementation of any project. Offered Winter, Summer. Prerequisite: MIS 674 or equivalent or permission.
678  Problems in Systems Design. Problems in systems design, analysis, implementation and management are presented, discussed and analyzed. The emphasis in this course is on developing an analytical ability for dealing with systems problems and a professional capability in planning and managing systems. Offered Spring. Prerequisite: MIS 676 or equivalent or permission.

679  Graduate Seminar in Information Systems. Formal aspects of the course will provide a framework for integrating the various areas and disciplines studied in other courses. Readings, classroom discussion and group participation will be required of all students. Offered Winter and Spring. Prerequisite: MIS 674 or permission.

683  Information Processing Management (cross-listed as CSC 483). The organization of the Information Systems Department, staffing, documentation and performance standards. The budget process. Design and layout of data processing facilities. Hardware/software specifications and selection. Offered variably. Prerequisite: MIS 676 or equivalent.

684  Computers in Society. The computer has had a profound effect on individuals, organizations and society as a whole. Its effects have been both positive and negative. Computer-based systems are currently implemented in virtually every field of endeavor and in the future will, in all likelihood, have an even greater impact than they have now. Developments within this field have occurred very rapidly over a relatively short period of time, so that we must now consider the implications of this revolution on the individual, on organizations, and on society as a whole. This course will examine the historical perspective, the computer industry, implications for the individual, effects on organizational practice, privacy and the quality of life, professionalism and ethics, and future trends. Offered variably. Prerequisite: MIS 670 or equivalent.

685  Security, Accuracy and Privacy in Computer Systems. Management decisions are increasingly being made on the basis of information provided to managers by the data processing system rather than on the basis of experience and intuition alone. In order for this information to be reliable, it must be accurate and its integrity must be maintained. Data and records are vital assets to an enterprise and therefore must be guarded against unauthorized access and manipulation just as other, more tangible, assets are guarded. Just as data and records are important to an enterprise and therefore must be accurate and secure, so are an individual's data and records important to him/her. Therefore, the issues of privacy—who is authorized to examine an individual's records—and accuracy—the completeness and correctness of the records—are critical. The three subjects are related in their technical solutions and hence should be considered together in the planning of computer installations. Offered variably. Prerequisite: MIS 676 or equivalent.

689  Decision Support Systems and Expert Systems. A seminar on the planning, design and implementation of decision support systems (DSS) and expert systems (ES). The emphasis of the course is on developing and building decision support systems. Consideration will also be given to end user computing and the evaluation and selection of DSS generators and ES skills. Students will gain hands-on experience in using DSS generators such as IFPS, prototyping languages such as FOCUS, and expert system skills. The course will include readings, a research paper and presentations. Offered Spring. Prerequisite: MIS 676 or equivalent or permission.
798 Special Topics. Content and format of this course are variable. An in-depth study of current issues in management information systems. Subject matter will be indicated in class schedule. Offered variably. **Prerequisite: as indicated in class schedule.**

Management

500 Managing People I. Students will critically examine and creatively solve problems of managing individuals and teams within organizations. Fundamental principles of perception, attribution, motivation and learning will be applied as participants engage in the study of leadership, empowerment, team development, managing innovation and change, decision processes, business ethics, and power and politics. **Prerequisite: graduate standing.**

502 Operations Management. This course provides an introduction and overview of the field of operations management. Students will learn how the operations function of a firm is responsible for the creation and distribution of goods and services. Major problems and ethical issues concerning the management of domestic and international operations are addressed. Quantitative and qualitative concepts of quality and continuous improvement are applied to both the manufacturing and service sectors. **Prerequisites: mathematics and statistics workshops, or equivalent.**

510 Quality Control. This course offers a treatment of several specific production and operations management functional areas including: statistical process control, total quality control, just-in-time, enhanced scheduling technologies, and productivity measurement. The interrelationship of these topics is identified and applications are discussed in various manufacturing and service environments. Offered Autumn, Spring. **Prerequisite: completion of Phase 1 or equivalent.**

580 Operations Research. This course focuses on a scientific approach to problem solving and model building. Topics covered include mathematical programming, integer programming, Markov processes, game theory and simulation. Emphasis is placed on application models, computer implementation and solutions. **Prerequisite: MGT 501.**

590 Management of Innovation and Technological Change. This course provides a foundation for managing technology in a competitive environment with global implications. Managing technology, whether in R&D or the finance department, requires the manager to understand, utilize and support technology. Technology is discussed as a critical component, along with people and skills, in adding value to products and services. Other topics discussed include entrepreneurship, a technology foundation, deployment of technology, and the industry evolution process. Selected emerging technologies and their future evolutions are studied. Offered Winter. **Prerequisite: completion of the internal and external environment courses or equivalent.**

Marketing

585 Marketing Information Systems for Decision Support. Course explores the development of a systems approach to the collection, analysis and distribution of marketing information within the organization. Topics include expert systems, data-base development and maintenance, and planning and control systems for marketing decision-making. Offered variably. **Prerequisite: MIS 500, ACC 553, MKT 555, and MKT 525 or equivalent.**
THE UNIVERSITY

CAMPUS

DePaul University has seven locations. The Lincoln Park Campus is situated about three miles north of the Chicago Loop in the vicinity of Webster (1200 N), Halsted (800 W) and Racine (1200 W). The College of Liberal Arts and Sciences, The School of Music, The School of Education and The Theatre School are located on the 30-acre campus.

The Loop Campus, between State Street and Wabash Avenue at Jackson Boulevard, houses the general administration of the University, the College of Law, the College of Commerce and the School for New Learning.

The Lake Forest Campus is located at 150 Field Drive, Lake Forest, Illinois (just east of I-94 at Route 60). The Naperville Campus is located at 150 West Warrenville Road, Naperville, Illinois (at I-88 and Naperville Road). The O'Hare Campus is located near O'Hare Airport at 3166 River Road, Des Plaines—just north of the intersection of River Road and Devon. The Oak Forest Campus is located at South Suburban Community College’s University and College Center, 16333 South Kilbourn Avenue, Oak Forest—at I-57 and 167th Street. The College of Commerce, the School of Computer Science, Telecommunications and Information Systems, the College of Liberal Arts and Sciences and the School for New Learning offer courses at a number of these sites.

UNIVERSITY LIBRARIES

The University Libraries provide resources and services to students, faculty, and staff through seven different units: The Lake Forest Campus Library, the Lincoln Park Library, the Loop Campus Library, the Naperville Campus Library, the O'Hare Campus Library, and the Oak Forest Campus Library. The delivery of information and materials is increasingly linked to computer and networking technologies. Electronic access to periodical articles, indexes, and other information resources in the social sciences, business, law, humanities, and sciences is readily available in all libraries.

Access to materials in all the DePaul Libraries is provided through ILLINET Online, the Libraries’ online catalog and circulation systems. The combined collection of the DePaul University Libraries includes over 700,000 volumes, 300,000 microform volumes, 9,000 current serial subscriptions, and a diverse microcomputer software and audiovisual collection.

ILLINET Online also allows users to identify books from over 45 other colleges and universities in Illinois, including the University of Illinois. Current DePaul students may choose to borrow directly from these institutions in person or request an interlibrary loan. Materials from other libraries across the United States can also be located and obtained through interlibrary loan.

Information, brochures, and bibliographies are available at all six locations and through the library link from DePaul’s World Wide Web site: http://www.depaul.edu.

The John T. Richardson Library at Lincoln Park supports programs in the College of Liberal Arts and Sciences, the School of Education, the School of Music, and the Theatre School. Collection areas of particular strength are religion, philosophy, and Irish studies. Facilities include a media area for using audiovisual materials and the Education Resource Center with curriculum materials for elementary and secondary school teaching, a slide library, a Career Information Center, and a collection of music recordings and scores. Rare book collections include the Napoleon Collection, the Dickens Collection, and the Sporting Collection, as well as numerous titles dealing with nineteenth century literature and book illustration. The University Archives houses materials documenting the growth and development of DePaul.

The Loop Campus Library primarily focuses on materials to support the programs of the College of Commerce and the School of Computer Science, Telecommunications and Information Systems, but also has a core collection of reference materials in other areas. Areas of
strength in the collections are accounting and finance. A Career Information Center provides
resources on career choice, job search techniques, and company information. A collection of
Corporate Annual Reports from Fortune 500 companies is maintained.

The College of Law Library has an extensive collection of Anglo-American legal materials
which provides both basic and advanced resources needed to support the law school curricu-

The Lake Forest, Naperville, O'Hare, and Oak Forest Campus Libraries offer an innovative
approach to library service by providing access to information using computers and telecom-
munications. The Library's networked electronic information resources include access to
ILLINET Online, and also provide access to periodical articles, business reports, indexes, an
cyclopedia and other reference sources. The Lake Forest, O'Hare and Oak Forest Campus
libraries have small, select print reference collections; the Naperville Campus Library has a
more significant collection of print materials including selected journals and books. Books and
other journal articles needed by students and faculty are delivered by a daily intra-university
shuttle service.
TECHNOLOGY AND COMPUTER RESOURCES
The services introduced below provide an overview of what is available to students from Information Services (IS), the division that brings computer and telecommunications technology to DePaul University. Students are encouraged to visit the Technology Resources page on DePaul University’s web site at www.depaul.edu or call IS’s Technology Assistance Center at (312) 362-8765 for specific information regarding locations, hours, and applicable fees.

IDENTIFICATION CARD SERVICES
Also known as ID Services, this office is a central distribution point for services and information affecting all DePaul students. ID Services distributes such essentials as identification cards, library bar codes, free student e-mail accounts, Personal Identification Numbers (PINs) and passwords. ID Services also coordinates CTA U-Pass distribution to eligible students at the beginning of each quarter. The main offices for ID Services are located at the Loop and Lincoln Park campuses; however, ID Services also has locations at the Suburban campuses to provide greater access to services. Call (312) 362-5959 or (773) 325-7466 for details.

COMPUTER LABS
Located on every campus, the Student MicroComputing Centers have over 500 computers available for students to work on course assignments, check e-mail, and use the Internet. Students can print homework in the computer labs, however, some restrictions may apply on quantity. Please note that some computer labs are reserved for specific purposes and may not be open to all students at all times.

DEPAUL ONLINE (DPO)
DPO provides students with access to the Internet from home via a dial-up computer connection. With this service students can browse the Internet, send and receive e-mail, read and post to Usenet Newsgroups, and create a personal web page. Students enrolled for classes are eligible for DePaul Online. DPO is compatible with computers that meet minimal technical requirements. To apply for DePaul Online or for more information, please visit service.depaul.edu/dpo/ or call the Technology Assistance Center at (312) 362-8765.

DEPAUL RESNET
In conjunction with Student Affairs, Information Services offers all residence hall students a free, high-speed Internet connection. Residence hall students who bring a computer and the Network Interface Card to DePaul can plug into the data jack in their room. Data connections make e-mail and Internet research convenient, because the student’s telephone line remains open when connected to the Internet and is approximately 20 times faster than a modem connection. Contact the Technology Assistance Center for details about the ResNet service including technical requirements. A concurrent subscription to DePaul Online is not required.

FREE STUDENT E-MAIL
Every currently enrolled student at DePaul University has an e-mail address. This e-mail account can be accessed from freestanding e-mail stations in the residence halls and student computer labs as well as through DePaul Online. Accounts are cancelled when courses are not taken for two consecutive terms.

ELECTRONIC REGISTRATION OPTIONS
Information Services has developed two electronic methods to supplement students’ registration options—NROL telephone registration and registration via the World Wide Web. Both NROL and Web Registration allow students to register for classes, add or drop classes, and review one’s class schedule. Web Registration also contains the following features: view a student’s personal registration start date, view a built-in schedule of class offerings, search for classes that meet department, campus or time requirements, link to course descriptions.
'point-and-click' on class selections, and print a completed schedule. Please direct inquiries regarding registration options and requirements to the Registrar's Office.

SKILL-BUILDING OPPORTUNITIES
Students may improve their basic computing skills through a software training program. Courses are offered throughout the year and provide instruction in Windows 95, Microsoft Office (Word, Excel, PowerPoint, and Access), and the Internet. Professionally prepared materials for all workshops are distributed to participants. Please visit service.depaul.edu to find course descriptions and registration procedures.

Free computer-based training is also available for the student who prefers to pursue training according to his or her own schedule. This training program is customized to each student's needs and can be accessed from computer labs or through DePaul Online or ResNet. Courses include several levels of the Microsoft Office suite plus other current software applications and can be found at swtrainer.depaul.edu.

TELECOMMUNICATIONS SERVICES
University housing provides telephone service for each student, including an individual phone number and voicemail box for each resident. Students supply their own telephones and are billed monthly for usage. Dial tone service is active when students move in and is included with room fees. Additional features are automatically added at no cost and include call waiting, three-way calling and call forwarding. This service utilizes university-owned telephone lines and equipment, therefore, some regulations apply to usage on the university telephone system.

CAREER CENTER
The University has two office locations offering career planning and placement services to graduate students and alumni, providing resources for those exploring career options as well as for those actively involved in a targeted job search. Appointments are available at either the Loop Campus, 9th floor, DePaul Center, or at the Lincoln Park Campus, first floor of the Schmitt Academic Center.

DePaul's Career Center professionals are committed to helping students and alumni develop skills in identifying career opportunities, and seeking out and securing satisfying employment. The tools utilized by the staff include career and job search seminars, mock interviews, career libraries on both campuses, vocational interest inventories, and individual counseling.

Both full- and part-time job leads are available through the Center. Leads for immediate openings are continually listed and updated, and an active on-campus interview program gives students and alumni access to career opportunities.

The Center has recently developed an innovative program for the registration of full-time job seekers. A computerized database allows candidate information to be matched to an employer's job specifications. Rapid turnaround time has dramatically improved the consideration given candidates referred from DePaul.

RESIDENCE LIFE
The University does not currently have housing for graduate students. The Residence Life Office, however, provides an off-campus housing listing service for DePaul faculty, staff and students. This service lists available apartments in the Lincoln Park area. The Residence Life Office is located at 2332 N. Clifton Ave. (773/325-7196). Office hours are Monday through Friday, 9:00 a.m. to 5:00 p.m.
ACCREDITATION

DEPAUL UNIVERSITY IS ACCREDITED BY
AACSB — THE INTERNATIONAL ASSOCIATION FOR MANAGEMENT EDUCATION
THE AMERICAN CHEMICAL SOCIETY
THE AMERICAN PSYCHOLOGICAL ASSOCIATION
THE ASSOCIATION OF AMERICAN LAW SCHOOLS
THE COMMISSION OF INSTITUTES OF HIGHER EDUCATION OF
THE NORTH CENTRAL ASSOCIATION OF COLLEGES AND SCHOOLS
THE NATIONAL ASSOCIATION OF SCHOOLS OF MUSIC
THE NATIONAL COUNCIL FOR ACCREDITATION OF TEACHER EDUCATION
THE NATIONAL LEAGUE OF NURSING

DEPAUL IS ON THE APPROVED LIST OF
THE AMERICAN BAR ASSOCIATION
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HONOR SOCIETIES

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BETA ALPHAL PSI
BETA GAMMA SIGMA
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MASTER'S PROGRAM REQUIREMENTS

For the master's degree, all programs involve the following: 1) credit hours, 2) thesis, or
comprehensive examination, and 3) program time limitation.

Credit Hours. For the master's degree, most programs for graduate students require fifty-
two quarter hours of course work.

Specific degree requirements are listed in the program sections of this Bulletin.

Thesis. The University offers the master's degree both with and without the thesis, however,
the thesis is required by some areas. The thesis is limited to the student's field of specialization
and should offer satisfactory evidence of the candidate's potential for scholarly research.

The student is advised to consult the School office for information regarding the required
form and type of paper to be used for the thesis. Responsibility for fulfilling these requirements
lies with the student, not the typist.

The student, after completing the thesis, will submit it to the director of his or her thesis
committee for consideration. The student will not be permitted to graduate until a subsequent
convocation. When the thesis is accepted, the student must file the designated number
of typewritten copies in the School office. The binding fee is $20.00 per copy, to be
submitted along with the copies of the thesis. The date of filing is published in the current
Bulletin and the class schedule or may be obtained directly from the School office. The responsi-
bility for meeting this deadline lies with the student.

Comprehensive Examination. The type and the subject matter of the examination follow the
regulations established in the various programs. If the student does not pass the examination,
the school or program may grant permission for another examination. The examination may
not be taken more than twice.

Program Time Limitation. Graduate students in master's programs are expected to com-
plete their program degree requirements within a six-year period from the first registration
date for a course in the program. When a graduate student fails to finish before the end of
the sixth year, the program director may recommend, on receipt of the student's petition,
in writing, to the dean, an extension of time with or without additional courses, examinations
or other conditions.

DOCTORAL PROGRAM REQUIREMENTS

The Doctor of Philosophy, the highest academic degree that DePaul University con-
ers, is offered by the School of Computer Science, Telecommunications and Infor-
mation Systems. The degree shows that the recipient has demonstrated proficiency
in a broad area of learning, as well as the potential to explore and advance that field of knowl-
edge by independent research.

Following are the minimum general requirements for all candidates for the Doctor of
Philosophy degree in the areas of 1) credit hours, 2) academic achievement, 3) residence,
4) admission to candidacy, 5) dissertation, 6) final examination and 7) program time limita-
tions. Additional requirements are stated in the program sections of this Bulletin.

Credit Hours. For the doctoral degree the graduate student will complete no less than 60
quarter hours of credit beyond the master's degree.

Academic Achievement. A student will be advised to withdraw from the doctoral program
when the School judges that the student is not maintaining satisfactory progress toward the
degree. Students are required to maintain at least a 3.5 average. A course grade below C is
unsatisfactory and will not be counted toward completing degree requirements. The determi-
nation of satisfactory progress is not limited to grades and grade point average, but includes
all factors in the student's performance.

Residence. At least three quarters beyond the master's level must be spent in full-time study
at DePaul University. Full-time study is defined as registration for a minimum of eight quarter
hours in a quarter. With prior approval of the school, the student may satisfy residency by course
work, by participation in seminars, or by research performed off campus.
To reflect the diversity of graduate study for the Ph.D. degree at stages other than the residency stage, doctoral candidates are full-time students who are registered for Reading and Research (four quarter hours), for Thesis Research (four quarter hours), or for Candidacy Continuation (zero hours credit).

**Admission to Candidacy.** Admission to candidacy implies that the faculty is satisfied that the doctoral candidate is sufficiently knowledgeable in the student's area of specialization and in the use of research tools to be able to prepare an acceptable dissertation.

For admission to candidacy the doctoral candidate shall complete three quarters of full-time study beyond the master's level. Other requirements include a comprehensive examination and related field study.

The School office will issue to each doctoral candidate a letter to authenticate admission to candidacy. Admission to candidacy will be entered on the doctoral candidate's academic record.

There is a time limit of four years between admission to the School of Computer Science, Telecommunications, and Information Systems and admission to candidacy. Once admitted to candidacy, the doctoral candidate must maintain registration in the University in each of the quarters of the academic year until the degree requirements have been completed. Among other courses, the following are appropriate to maintain registration: Independent Study (four quarter hours), Resident Candidacy Continuation (non-credit), or Non-Resident Candidacy Continuation (non-credit). Failure to comply with the policy governing registration in the University, in each of the quarters of the academic year until the degree requirements have been completed, may result in dismissal from the doctorate program. Candidacy status may be reinstated only after the student has applied for readmission (see Readmission Procedures).

**Dissertation.** The doctoral candidate will prepare a dissertation based on the student's research. The purpose of the dissertation is to evidence both one's scholarship and ability to carry on such independent research as definitely contributes to the advancement of knowledge. The topic of the dissertation should be submitted to the dissertation advisor who will assist the student in forming a dissertation committee to approve the topic and to assist the doctoral candidate through all stages in the preparation of the dissertation. The chairperson of this committee is the dissertation advisor.

All doctoral dissertations are to be microfilmed. After all requirements have been completed, the doctoral candidate submits to the School office the designated number of typewritten, unbound, final copies of the dissertation. (The first copy is to be in satisfactory condition for microfilming.) The candidate also prepares and submits a 350-word abstract of the dissertation. The abstract will be published in Dissertation Abstracts and will include an announcement that the dissertation is available in film form. One microfilm copy will be deposited in the University Library and will be available for interlibrary loan.

To defray the costs of microfilming and publication, a fee of $75.00 is collected when dissertation copies are submitted.

Microfilming is considered by the University to be a form of publication. Publication by microfilm, however, does not preclude the printing of the dissertation in whole or in part in a journal or monograph.

**Final Examination.** The dissertation is the principal basis of the final examination. After completing the dissertation, and at least eight months after admission to candidacy, candidates should submit a petition for the final examination to the School. After the exam, the chair of the committee sends a report on the results, signed by all committee members, to the School office.

When these steps have been completed, the doctoral candidate becomes eligible for degree conferment at the next convocation.

**Program Time Limitations.** For graduate students in a doctoral program, the time limits to
complete the requirements for the Doctor of Philosophy degree are 1) between admission to the doctoral program and admission to candidacy, not more than four years; and 2) between admission to candidacy and the final examination, not less than eight months, and not more than five years.

**ACADEMIC INFORMATION AND REGULATIONS**

This bulletin is the official statement of the requirements, rules, and regulations for the Graduate Programs offered by the School of Computer Science, Telecommunications, and Information Systems. This bulletin does not constitute a contract between the student and the University. Every effort has been made to provide accurate and current information. The University reserves the right to revise the content of its Bulletins and Schedules, and to change policies, programs, requirements, rules, regulations, procedures, calendar, and schedule of tuition and fees, to establish and modify admission and registration criteria, to cancel or change courses or programs, and to limit and restrict enrollment. To cancel, divide or change time or location of staff and classes, or to make any other necessary changes.

A student upon admission to a graduate program is to follow the bulletin requirements in effect at the time of entrance. A student who is readmitted or who changes his or her program or enrollment status is subject to the terms of the bulletin in effect at the time of readmission or status change.

As a graduate student you assume the responsibility to know and meet both the general and particular regulations, procedures, policies, and deadlines set forth in this bulletin. All students are expected to adhere to the Student Code of Responsibility found in the Student Handbook. The University follows the requirements outlined in the Family Educational Rights and Privacy Act of 1974 which outlines the rights of students to review their educational records. The procedures for such review and the rights of students in this regard are set forth in the Student Handbook.

Certain student information, known as "Directory Information," may be disclosed by the institution to outside parties unless the student has specifically requested that this information not be released. DePaul University considers the following to be Directory Information: name, address, telephone number, college of enrollment, class, major field of study, dates of attendance, degrees and awards received, the most recent educational agency or institution attended by the student, and participation in officially recognized activities and sports. Students who do not want Directory Information released should make a written request to the Office of the Registrar to withhold this information.

**ACADEMIC COUNSELING**

Academic counseling helps to ensure successful completion of graduate studies. If you are a degree-seeking student, contact your faculty advisor. If you are a non-degree seeking student or a student-at-large, contact either your graduate division office, or the appropriate department or program director.

**COURSES AND CREDIT**

No one is permitted to attend a class for which he or she has not been properly registered. Credit is accumulated on the basis of quarter hours. The unit of credit is one quarter hour granted for 45 minutes of classroom work a week. The normal class extends over a ten-week period (or an accelerated five-week period in the summer). All courses carry four quarter hours of credit (2 2/3 semester hours), unless otherwise noted.

Students enrolled for eight or more quarter hours of credit are considered full-time. Those enrolled for less are considered part-time. For students fully employed, registration for two courses in a term is the suggested maximum.
Courses numbered 300 through 399 are advanced undergraduate courses. If listed in this Bulletin, they may be accepted for graduate credit within the limitations stipulated by the specific departmental chair or program director.

**GRADES**

Following is the key to the system of evaluating the academic achievement by the student of the educational objectives specified by the instructor in the course syllabus. These definitions apply to the straight letter grade. A plus grade represents slightly higher achievement than the straight letter grade. A minus grade represents slightly lower achievement than the straight letter grade.

**A** The instructor judged the student to have accomplished the stated objectives of the course in an EXCELLENT manner.

**B** The instructor judged the student to have accomplished the stated objectives of the course in a VERY GOOD manner.

**C** The instructor judged the student to have accomplished the stated objectives of the course in a SATISFACTORY manner.

**D** The instructor judged the student to have accomplished the stated objectives of the course in a POOR manner.

**F** The instructor judged the student NOT to have accomplished the stated objectives of the course.

**IN** Temporary grade indicating that the student has a satisfactory record in work completed, but for unusual or unforeseeable circumstances not encountered by other students in the class and acceptable to the instructor is prevented from completing the course requirements by the end of the term. An incomplete grade may not be assigned unless the student has formally requested it from the instructor, and the instructor has given his or her permission for the student’s receiving an incomplete grade.

**R** Student is making satisfactory progress in a course that extends beyond the end of the term or in a project extending over more than one quarter.

**W** Automatically recorded when the student’s withdrawal is processed on or before the date designated in the academic calendar for such a withdrawal.

**FX** Student stopped attending course. This is an apparent withdrawal. The grade can be changed to a “W” grade by the college administration without consulting the instructor if it is determined that the student attempted to withdraw but followed incorrect procedures, or for other administrative grounds. If not administratively removed, it is scored in the grade point average the same as an “F.” Students are advised to contact their college office to initiate the request to correct an FX grade. An FX grade may not be changed if it has remained on the student’s record beyond twelve months except in extraordinary circumstances.
QUALITY POINTS

Quality points are awarded to a student in relation to the grade given and the number of quarter hours of credit attempted in the course. Quality points are awarded according to the following schedule:

- A: 4 times as many quality points as the credit hours assigned to the course.
- A−: 3.7 times the number of credit hours.
- B+: 3.3 times the number of credit hours.
- B: 3 times the number of credit hours.
- B−: 2.7 times the number of credit hours.
- C+: 2.3 times the number of credit hours.
- C: 2 times the number of credit hours.
- C−: 1.7 times the number of credit hours.
- D+: 1.3 times the number of credit hours.
- D: 1 quality point for each credit hour in the course.
- F, FX: (no quality points)
- W, INC, R: (quality points not assigned)

Illustration

<table>
<thead>
<tr>
<th>Grade</th>
<th>Quality Points Per Credit Hour</th>
<th>Credit Hours Attempted</th>
<th>Quality Points Merited</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>A−</td>
<td>3.7</td>
<td>4</td>
<td>14.8</td>
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<tr>
<td>B+</td>
<td>3.3</td>
<td>4</td>
<td>13.2</td>
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<tr>
<td>B</td>
<td>3</td>
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<td>12</td>
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<tr>
<td>B−</td>
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<td>C+</td>
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<tr>
<td>C</td>
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<td>4</td>
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<td>C−</td>
<td>1.7</td>
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<td>D+</td>
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<tr>
<td>D</td>
<td>1</td>
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<td>4</td>
</tr>
<tr>
<td>F, FX</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

W, INC, R: Quality Points not assigned.

GRADE REQUIREMENTS

You must achieve a minimal grade point average of 2.500 to graduate. A grade of D+ or D is unacceptable for graduate credit, and if earned in a required course, the course must be repeated or substituted as directed by the chair of the area of concentration. D+ or D grades remain on the academic record and are calculated into the cumulative grade point average.

PROBATION AND DISMISSAL

A student is subject to Probation as soon as his/her graduate GPA falls below 2.500. The student remains on Probation until four more courses are taken, at which time another evaluation is made. If, at that time, the student has failed to raise his/her GPA to the required level of 2.500, the student may be dismissed for poor scholarship, and prohibited from registering for additional course work.

A student who has been dismissed may, after a period of time, petition for reinstatement. The petition, addressed to dean of the respective graduate division, would provide information that would demonstrate a change in the student's circumstances to an extent that would support successful completion of the student's degree program. The dean's decision, based upon the merits of the petition and the recommendation of the faculty of the student's department, may, if favorable, stipulate conditions of reinstatement.
PLAGIARISM
Plagiarism is a major form of academic dishonesty involving the presentation of the work of another as one's own. Plagiarism includes, but is not limited to the following:
- The direct copying of any source such as written and verbal material, computer files, audio disks, video programs, or musical scores, whether published or unpublished, in whole or in part, without proper acknowledgement that it is someone else's.
- Copying of any source in whole or in part with only minor changes in wording or syntax even with acknowledgement.
- Submitting as one's own work a report, examination paper, computer file, lab report, or other assignment which has been prepared by someone else. This includes research papers purchased from any other person or agency.
- The paraphrasing of another's work or ideas without proper acknowledgement.

Plagiarism, like other forms of academic dishonesty, is always a serious matter. If an instructor finds that a student has plagiarized, the appropriate penalty is at the instructor's discretion. Actions taken by the instructor do not preclude the college or the university taking further punitive action including dismissal from the University.

For further information about the University's policies on academic integrity please consult the Student Handbook.

REGISTRATION PROCEDURES
Students enrolled at any time during the previous calendar year are eligible to register.
Continuing students register by telephone using DePaul's NROL telephone registration system. Complete instructions will be mailed to all continuing, new and readmitted students.

REGISTRATION IN COURSES IN OTHER COLLEGES OR SCHOOLS
Graduate students may be permitted to register for courses offered in other colleges or schools of the University. Contact your graduate office for specifics.

RESIDENCE REGISTRATION
Whether in residence or not, all admitted graduate students, masters and doctoral levels who will use the facilities of the University (library, laboratory, etc) or who will consult with faculty members regarding theses, dissertations or examinations must be registered in each quarter.

GRADUATION PROCEDURES
DEGREE REQUIREMENTS
You must have successfully completed all of the general and specific degree requirements as listed in departmental or program sections of the bulletin under which you were admitted. Completed degree requirements can include the submitting of the dissertation or thesis or the research paper, examination scores, and, if necessary, grade changes. Students need to achieve a minimum grade point average of 2.500 to graduate.

GRADUATION WITH DISTINCTION
Conferral upon a student who has maintained a 3.75 grade point average in the degree program, and passes with distinction the final oral, written examination or master's papers with distinction, where applicable.

COMMENCEMENT
Graduation ceremonies are held in June of each year. If you cancel or are ineligible to graduate, you must reapply for the next convocation.

DIPLOMA
Graduation ceremonies are symbolic. Your diploma will be mailed shortly after the convocation.
DEADLINES
Specific dates are established for submission to the graduate office of the completed graduation application and for completion of graduation requirements. Contact the office for specifics.

TUITION AND FEES
DePaul University is a not-for-profit corporation. No student pays the actual cost of his or her education. Tuition and fees are held at their present level through gifts of alumni, foundations, corporations, the Vincentian priests, and brothers and friends of the University. All policies are under continual review. Therefore, the Board of Trustees reserves the right to change charges as conditions require.
Tuition and fees for services and materials are for the academic year 2000-2001 and are applicable only to graduate students.

GRADUATE STUDENT TUITION, PER QUARTER HOUR
Computer Science, Telecommunications and Information Systems
100-200 series, per hour........................................................................................................... $303.80
300-700 series, per hour...........................................................................................................455.00

GENERAL FEES
Fees are not refundable
Graduate Application Fee........................................................................................................... $25.00
Readmission Fee.........................................................................................................................5.00
Registration Fee.........................................................................................................................10.00
Delinquency Fee..........................................................................................................................100.00
Deferred Examination Fee
On Designated Dates.................................................................................................................... 10.00
At Times Not Designated...........................................................................................................20.00
Doctoral Dissertation Fee.......................................................................................................... 75.90
Thesis Binding (Per Copy).........................................................................................................10.00
Each Transcript of Credit Fee....................................................................................................5.00
Each Returned Check Fee............................................................................................................*25.00

* If a student gives the University a check that is returned by the bank upon which it is drawn marked “Insufficient Funds,” “Payment Stopped,” or “Account Closed,” a $25.00 charge will be assessed for each such occurrence.

Note: Fees subject to change without prior notice.

COMPUTER FEES
Students enrolling in courses that require computer resources may be assessed one or more computing fees. Revenues from these fees support the maintenance and upgrade of academic computing systems and facilities. Courses requiring these fees are noted in the class schedule. For some courses, instructors may require computer fees that are not shown in the schedule. These fees will be billed to the student’s tuition account, as appropriate.

Student Internet Fee. DePaul students can purchase Internet access accounts for a non-refundable charge of $25.00 per term or $90.00 per year. Only active DePaul students are eligible to participate in this service. Faculty may require students to have Internet access for their courses. Students can sign up for Internet access through Academic Technology Development, 126 Richardson Library and 1300 Levis Center. The Internet fee will be billed directly to the student’s tuition account.

Student Computing Fee. Student enrolled in courses requiring student accounts on the UNIX or IBM system will be assessed a $25.00 fee per course.

PC Classroom Fee. Students enrolled in courses that meet for five or more sessions in one of the PC classrooms will be assessed a $25.00 fee per course.
MATERIAL FEES

See individual course descriptions for specific material fees.

TUITION PAYMENT POLICY

All tuition and fees are due DePaul University at the time of registration. All charges must be paid in-full by the payment date. The payment dates for each term of the 1999-2000 academic year are:

- **Friday, September 1, 2000—Fall Quarter**
- **Friday, December 8, 2000—Winter Quarter**
- **Friday, March 16, 2001—Spring Quarter**
- **Friday, June 15, 2001—Summer I**
- **Friday, July 20, 2001—Summer II**

Tuition charges for any course registrations after the payment date must be paid in-full at the time of registration.

Tuition is due by the payment date whether or not a bill has been received. If you have not received a bill, you may contact the Student Financial Services Office at (312) 362-8379 or (312) 362-8480 any time during business hours to determine the amount you are required to pay.

Payment must be received in the Cashier's Office or one of its depositories by the payment dates as indicated. Students may pay by check, money order or credit card (Visa, Master Card or Discover). Payments may be made to the Cashier's Office by mail or in person, or if paying by credit card, by phone (312) 362-8480. (Please note: If paying by mail, the University does not accept responsibility for delays in the U.S. Postal Service.)

Students whose accounts show a balance due after the date payment is required will be assessed a $100 delinquency fee and prohibited from future registration and receiving transcripts. Any requests appealing assessment of delinquency fees must be submitted in writing to the Student Accounts department.

BILLING

Bills will be printed and mailed when a registration is recorded. Payment must be made by the published payment date to avoid delinquency-fee assessment regardless of whether or not a bill is received. If a bill is not received, students may contact the Accounts Receivable Office at (312) 362-8480 for information relative to charges due. Revised bills will be issued for enrollment changes made after the initial registration.

For registrations and enrollment changes made after the payment date for a term, payment is due within two business days. Although bills will be issued, to make timely payment students should contact Accounts Receivable for information regarding tuition charges.

If a student loses or misplaces his or her bill and needs a copy of the tuition account for records or for employer reimbursement, a printed copy of the account may be obtained from the Student Accounts department.

WITHDRAWAL

Students who must withdraw either from a course or from the University may do so in person at their home college, by letter addressed to the college, or by using the University's telephone registration system when appropriate. Withdrawals processed via NIROL or in person are effective the day on which they are made. Withdrawals processed as a result of a letter are effective at the discretion of the college office. Simply ceasing to attend, or notifying the faculty, or nonpayment of tuition does not constitute a withdrawal of record and will result in academic as well as financial penalty.
Upon processing of the withdrawal request, the tuition charge for courses during the regular academic year will be reduced according to the following schedule, where the effective date is:

Until ten business days after the beginning of the term ............ ............... ............... 100%
After that date ............................................................................................... 0%

For courses of four weeks or less but more than two weeks duration no reduction will be granted after the first week of the term. For workshops or courses of two weeks or less duration, no refunds will be granted after the workshop or sessions begin.

For the Summer sessions, consult the schedule of tuition, fees and refunds listed in the Summer classes booklet.

Fees are not refundable.

NOTE: Students receiving financial aid are advised to contact a Financial Counselor to discuss the consequences of a withdrawal effecting academic progress and eligibility at DePaul University or any other school to which they may transfer.

REFUNDS
Should an account result in a credit balance which is refundable to the student and not the result of Title IV financial aid, the student has the option of leaving the credit on the account to be applied toward future term expenses, or apply for a refund through the Cashier's Office or the Student Accounts office.
Application for a refund may be made to the Cashier's Office by a telephone request or in person. Refund checks will be made payable to the student and mailed to the address the student has on file with the University. Refunds resulting from a credit card payment will be issued back to the credit card.

Students who receive Title IV financial aid are required to submit a Refund Preference Form to the Cashier's Office. If an account results in a credit balance which is refundable, as the result of the receipt of Title IV payments, a refund will be generated according to the preference on file.

Please Note: Financial Aid awards (grants and scholarships) cannot be considered for refunds until the course add/refundable drop period is closed.

GENERAL NOTES
1. Registration cannot be accepted from a student with an unpaid balance from a prior term. Registration attempted under these circumstances is subject to cancellation.
2. Tuition and fees for courses audited are charged at the regular tuition rates. These must be paid at the time of registration and are not refundable.
3. If a student gives the University a check that is returned by the bank upon which it was drawn, marked "Not Sufficient Funds," "Payment Stopped," "Refer to Maker," or "Account Closed," a $25.00 charge will be assessed for each such occurrence. The University reserves the right to refuse acceptance of a personal check without prior notice.
4. Any foreign checks must be made payable in United States dollars or they will not be accepted by the University.

FINANCIAL ASSISTANCE
Several types of financial aid are available to graduate students through programs administered by the University graduate school departments. These include DePaul University graduate assistantships as well as special awards funded by foundations and corporations.

In addition, the DePaul Office of Financial Aid administers a variety of loan programs for which graduate students are eligible to apply.
LOANS

DIRECT LOAN PROGRAM. Federal Direct Loans are a new way for students to borrow money from the federal government to pay for university expenses. Under this program, the U.S. Department for Education makes loans through schools, directly to students.

There are two types of Direct Loans—subsidized and unsubsidized. Eligibility for subsidized Direct Loans is based on financial need. Repayment is deferred until six months after you graduate or cease to be enrolled at least half-time, and the interest is paid by the government while you are enrolled in school. Eligibility for unsubsidized Direct Loans is not based on financial need. You may borrow the cost of education minus all other financial aid you receive, up to the Direct Loan maximum. However, the interest must be either paid by you while you are enrolled, or be accruing and capitalized to the principal. Repayment of the principal is deferred until after you graduate or cease to be enrolled at least half-time.

The interest rate on the Direct Loan is variable but cannot exceed 8.25 percent. In addition, there is an origination fee of 4 percent charged to the borrower and deducted from the loan proceeds before disbursement.

GRADUATE STUDENTS

<table>
<thead>
<tr>
<th>Subsidized Direct Loan Maximum</th>
<th>Total Direct Loan Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>$8,500</td>
<td>$18,500</td>
</tr>
</tbody>
</table>

Graduate students may borrow the subsidized Direct Loan up to the maximum indicated above, and may supplement this amount with the unsubsidized Direct Loan. The total combined subsidized and unsubsidized Direct Loan may not exceed $18,500.

ALTERNATIVE FINANCING

DEPAUL UNIVERSITY

The DePaul University Payment Plan (DePUP) is a budget payment option which allows students to pay their tuition, fees, and room and board in monthly installments over a 9, 8 or 7 month period. This service is available to all DePaul University students. It is not a loan program, there are no interest or finance charges, or credit or financial needs requirements.

The student determines the budget amount for the plan. DePUP requires a minimum budget amount of $750.00. The budgeted amount is the student’s total estimated annual charges (tuition, fees, room and board) less the total estimated financial aid awards (annual scholarships, grants, loans). Books and personal expenses are not covered by this budget. The total amount budgeted under the plan will be divided equally over the number of months in the plan at the time you apply.

The plan period is from July to March with payments due the 25th of each month. The student may pay by check, money order, credit card (VISA, Master Card, Discover, or College Card) or Electronic Funds Transfer.

Monthly billing statements will be sent to the student in advance of each payment due date. The statement will reflect charges and any payments or credits received since the last bill, the payment plan amount due by the 25th, and the current outstanding balance.

Students are urged to apply early. To participate in the nine month program, applications must be received by the Accounts Receivable Office no later than June 26.

Applications received after August 26th but prior to September 26th will be processed for Winter/Spring term registrations only. Payments for the budgeted amount will be over a six-month period with the first payment due October 25th, and the last payment due March 25th.
Students who wish to participate in DePUPP should complete and submit a plan application to the Accounts Receivable Office with the application fee by the appropriate due date. An annual, non-refundable fee of $35.00 is required for each application.

The application is valid for one academic year only. For each year a student wishes to participate in this program, a new application must be submitted.

More detailed information regarding this program and plan applications are available from the Student Accounts Department and the Financial Aid Office.

Any questions regarding DePUPP should be directed to the Accounts Receivable Office, (312) 362-8480 or you may write to Accounts Receivable Office, DePaul University, 1 E. Jackson Blvd., Chicago, IL 60604.

The DePaul Payment Plan for Employer Reimbursement is a payment option for students who receive tuition reimbursement from their employers. It is administered through the Student Accounts Office of Student Financial Services. The payment plan is designed to view coverage by an employer tuition reimbursement program as pending payment. Since employer reimbursement is generally issued at the end of a term, this payment plan allows the students covered by such an employer reimbursement plan to receive an extended payment due date for their tuition charges. Regardless of when the employer reimburses the student, the tuition due dates are not negotiable. Bills and grades will be issued to the students only, and not to the employers. It is the responsibility of the student to provide their employers with copies of any documents their employer may require.

Eligibility Requirements: Students must submit the application and related fee by the application deadline. If there is a doubtful account history, past due balance or insufficient employer documentation, the student will not be accepted into the program. If at anytime the student fails to withdraw in payment, the payment plan privilege is no longer available.

Eligible Courses: To be eligible to participate in the program, students must be enrolled in the traditional quarterly courses which are 10 weeks in duration (Summer courses special seminars, extended courses, workshops, courses which require prepayment, audits and zero credit courses are not covered in this program.

Financial Aid: Students are not eligible for this program if they have also applied for financial aid. This program is designed to assist students who do not receive financial aid. There are no exceptions to this policy.

Payment: Regardless of when the employer reimburses the student, it is the student's responsibility to pay the balance in full on or before the tuition due date. Students who experience this delay from their employers typically pay tuition using a credit card. Students are responsible for paying their tuition accounts in full by the due date. Whether they have completed the work for their courses whether or not they have received reimbursement from their employer. Tuition due dates are not negotiable, and delinquent fees will apply to students who do not meet the tuition due date deadlines. Failure to meet the application agreement will jeopardize future participation in the program and may prevent future enrollment.

How to apply: Applications are available in the Student Financial Services Offices of Student Accounts and Student Aid, the college offices and suburban campuses. Submit the completed application and fee to the Payment Center by the required deadline. You will be notified only if your application has been denied. Do not return the application and fee to the college—this will delay processing and acceptance into the program.
FEES/APPLICATIONS

<table>
<thead>
<tr>
<th>Term</th>
<th>Fee</th>
<th>Application Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall, Winter, Spring terms</td>
<td>$100.00</td>
<td>One time application for 3 quarters</td>
</tr>
<tr>
<td>Fall term only</td>
<td>40.00</td>
<td>Quarterly application</td>
</tr>
<tr>
<td>Winter term only</td>
<td>40.00</td>
<td>Quarterly application</td>
</tr>
<tr>
<td>Spring term only</td>
<td>40.00</td>
<td>Quarterly application</td>
</tr>
<tr>
<td>Summer Session I term</td>
<td>40.00</td>
<td>Quarterly application</td>
</tr>
<tr>
<td>Summer Session II term</td>
<td>40.00</td>
<td>Quarterly application</td>
</tr>
</tbody>
</table>

All fees are non-refundable.

**Term** | **Application Deadline Date** | **Extended Payment Due Date**
--- | --- | ---
Fall quarter | Friday, August 25, 2000 | January 12, 2001
Winter quarter | Friday, December 1, 2000 | April 13, 2001
Spring quarter | Friday, March 9, 2001 | July 13, 2001
Summer Session I | Friday, June 8, 2001 | September 7, 2001
Summer Session II | Friday, July 13, 2001 | October 5, 2001

If mailing the applications, remember to include the fee. The University does not accept responsibility for delays in the U.S. Postal System.

For information about the Payment Plan for Employer Reimbursement, call the Student Accounts office (312) 362-8480.

PRIVATE AGENCIES

Other sources of loan funding are made available through private agencies for those who feel their needs have not been met sufficiently or those who are determined to be ineligible for other types of financial aid.

There are several long term loan programs available, including the TERI PEP Loan and the Nelle Mae Grad EXCEL Loan.

For more information about these and other alternative financing programs, contact the Office of Financial Aid.

PART-TIME EMPLOYMENT

Student Service employment takes the form of on-campus work with the full salary paid by DePaul. Any student wishing to work on campus may be eligible under this program as long as they are not receiving other need-based aid that would be affected by such earnings. If you would like to work on campus, check with the Student Employment Office at the Loop or Lincoln Park Campuses to see if you are eligible.

HOW TO APPLY

For more information about financial aid programs, contact DePaul University's Office of Financial Aid, 1 E. Jackson Blvd., Chicago, IL 60604. Telephone (312) 362-8091

ASSISTANTSHIPS

The University provides a number of teaching, research, and administrative assistantships to applicants accepted as degree-seeking, fully-admitted graduate students. Application should be made to the School of Computer Science, Telecommunications and Information Systems.

New applicants must have all their credentials (completed application form, admission fee, duplicate copies of transcripts and letters of recommendation) on file in the appropriate graduate office no later than the February 15 prior to Autumn quarter admission.

Announcement of Graduate Assistantships is generally made by June 1. Assistantships must be accepted or declined, in writing, by July 1.

Recipients will be assigned by their program directors or departments to activities appropriate for a teaching, research or administrative assistant.
### Autumn Quarter
- **September 1:** Friday, Autumn tuition payment due.
- **September 4:** Monday, Labor Day.
- **September 6:** Wednesday, Autumn quarter evening classes begin.
- **October 4-10:** Wednesday - Tuesday, Mid-term week (optional).
- **October 27:** Friday, Last day to withdraw from classes.
- **November 14:** Tuesday, Last day of Autumn quarter evening classes.
- **November 15-21:** Wednesday - Tuesday, Final examinations for Autumn quarter evening classes.
- **November 22:** Wednesday, End of Autumn quarter.
- **November 23-26:** Thursday - Sunday, Thanksgiving holiday.
- **December 8:** Friday, Winter tuition payment due.

### Winter Quarter
- **January 8:** Monday, Winter quarter evening classes begin.
- **February 5-9:** Monday-Friday, Mid-term week (optional).
- **February 23:** Friday, Last day to withdraw from classes.
- **March 16:** Friday, Last day of Winter quarter evening classes.
- **March 19-23:** Monday-Friday, Final examinations for Winter quarter evening classes.
- **March 23:** Friday, Spring tuition payment due.
- **March 26:** Friday, End of Winter Quarter.

### Spring Quarter
- **March 31:** Saturday, Spring quarter Saturday classes begin.
- **April 2:** Monday, Spring quarter evening classes begin.
- **April 13-15:** Friday - Sunday, Easter holiday — no classes.
- **April 30-May 4:** Monday - Friday, Mid-term week (optional).
- **May 25:** Friday, Last day to withdraw from classes.
- **May 28:** Monday, Memorial Day holiday — no classes.
- **June 1:** Friday, Last day of Spring quarter classes.
- **June 9-15:** Saturday-Friday, Final examinations for Spring quarter classes.
- **June 15:** Friday, Spring quarter ends. Summer I tuition payment due.
- **June 16-17:** Saturday-Sunday, Commencement.

### Summer Sessions
- **June 18:** Monday, Summer Session I begins.
- **July 4:** Wednesday, Independence Day holiday.
- **July 5:** No classes.
- **July 20:** Friday, Summer Session I ends.
- **July 20:** Friday, Summer Session II tuition payment date.
- **July 23:** Monday, Summer Session II begins.
- **August 24:** Friday, Summer Session II ends.
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DePaul, a Catholic university, takes its name from St. Vincent de Paul. The religious community founded by Vincent, commonly known as 'Vincentians,' opened the university and endowed it with a distinctive spirit, to foster in higher education a deep respect for the God-given dignity of all persons, especially the materially, culturally and spiritually deprived, to instill in educated persons a dedication to the service of others. In each succeeding generation the women and men of DePaul have pursued learning in this spirit of Vincent de Paul.