DEPAUL UNIVERSITY BULLETIN

SCHOOL OF
COMPUTER SCIENCE,
TELECOMMUNICATIONS
AND INFORMATION
SYSTEMS
GRADUATE PROGRAMS

1998-2000
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.
MASTER OF SCIENCE IN COMPUTER SCIENCE

MASTER OF SCIENCE IN DISTRIBUTED SYSTEMS

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

M.S. IN MANAGEMENT INFORMATION SYSTEMS/
JOINT DEGREE

DOCTOR OF PHILOSOPHY IN COMPUTER SCIENCE
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COMPUTER SCIENCE,
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STATEMENT OF VINCENTIAN CHARACTER

Note: The University reserves the right to revise its Bulletins and Schedules. See page 77 for further details.
The School of Computer Science, Telecommunications and Information Systems (CTI) offers courses at our Loop and Lincoln Park Campus as well as at two convenient suburban locations.

**LINCOLN PARK CAMPUS**  
2320 North Kenmore Avenue  
Chicago, Illinois 60614  
312-362-8714

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

**NAPERVILLE CAMPUS**  
150 West Warrenville Road  
Naperville, Illinois 60566  
630-548-9378  
(selected course offerings)

**O'HARE CAMPUS**  
3166 River Road  
Des Plaines, Illinois 60018  
847-296-5348  
(selected course offerings)

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 two suburban campuses, most students will be able to take increasing advantage of these locations.
SCHOOL OF

COMPUTER SCIENCE,

TELECOMMUNICATIONS AND

INFORMATION SYSTEMS
ADMINISTRATION

Helmut Epp, Ph.D.
Dean

David P. Miller, Ph.D.
Associate Dean

Anne B. Morley
Director, Student Services

PHILOSOPHY

FACULTY

PURPOSES

FACILITIES

ADMISSION

PROGRAMS

Master of Science
Computer Science
Distributed Systems
Human-Computer Interaction
Information Systems
Software Engineering
Telecommunication Systems
Management Information Systems

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 man and woman. 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

HELMUT EPP, Ph.D.
Associate Professor and Dean
Northwestern University

L. EDWARD ALLEMAND, Ph.D.
Professor Emeritus
University of Louvain

EHAB S. AL-SHAER, Ph.D.
Assistant Professor
Old Dominion University

GARY ANDRUS, Ph.D.
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State University of New York at Stony Brook

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University of Chicago

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Northwestern University

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Associate Professor
Harvard University

JACOB D. FURST, Ph.D.
Assistant Professor
University of North Carolina at Chapel Hill

GERALD GORDON, Ph.D.
Associate Professor
University of California, Berkeley

HENRY HARR, Ph.D.
Associate Professor
Illinois Institute of Technology

ALAN JEFFREY, Ph.D.
Visiting Associate Professor
Oxford University

XIAOPING JIA, Ph.D.
Associate Professor
Northwestern University
PURPOSES

The School of Computer Science, Telecommunications and Information Systems (CTI) offers graduate level, professional education in these areas: artificial intelligence, computer science, computer graphics, data analysis, database, data communications, distributed systems, human-computer interaction, information systems, management information systems, project management, software engineering, 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 Division (ISD) houses a large network of computers and allows students access to a rich computing environment. The configuration includes several Sun SPARCcenters for student use. In addition, students have access to IBM PC laboratories and Macintosh laboratories at the Loop and Lincoln Park campuses. There are numerous dial-up phone numbers available for off-campus work. DePaul's suburban campuses in the Naperville, O'Hare and South 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 artificial intelligence, computer vision and graphics, software engineering, telecommunications, local area networks and computer telephony. One laboratory allows students to explore specialized software. 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.

ISD and School computers are connected through multiple Ethers. The School's computers and laboratories form several subnets using TCP/IP. A separate Starlan network connects the ISD IBM PC laboratories. DePaul is connected to the Internet through 2 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.

Application Form: Applicants can obtain a graduate application form either 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 their proposed program of study in their request.

Application deadlines for MS applicants are:

- August 1 for Autumn Quarter
- December 1 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

NOTE: An undergraduate DePaul senior is eligible to submit an application to the graduate program before completing the undergraduate program.

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 their request as early as possible, because there is frequently a delay in the forwarding of transcripts. An undergraduate DePaul senior applying to the Graduate School should request the registrar to forward an official transcript to the School of CTI office. A written recommendation for admission from the student's current chairperson or program director should also be provided.

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 their 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 can take from four to six weeks.

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 make application as early as possible. There are usually long delays in the forwarding of all supporting credentials.
READMISSION PROCEDURES

Both applicants and students of CTI must apply for readmission if a certain amount of time has elapsed since they have last enrolled in the School of CTI. Along with the application for readmission, there is a $5.00 service fee for processing a readmission form.

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. Current students of CTI must also reapply 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 or longer, but not more than four calendar years. The form must be submitted at least two weeks prior to the day of registration for the term in which the student expects to resume their studies. If more than four years have elapsed since the student has been in attendance, the student must file a new application (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 their status can be updated to full degree-seeking status. A student must also file a Change of Concentration/Status application if they decide to change their major. As a general rule, students are held to the degree requirements that are in effect at the time the student changes their 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 pursuing 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 a 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 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 sub areas 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 their 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.

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 this course.)

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 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 offices 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. Students must complete the Prerequisite Phase before beginning the Core Knowledge Phase. However, while completing the Prerequisite Phase courses, students may take Core Knowledge Phase courses with consent of their faculty advisor. Fully admitted students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses prior to passing the Core Knowledge Examination. A student must receive a grade of C- or better in each of the Core Knowledge Phase courses, and also in subsequent courses in the degree program. 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. This examination covers the subject matter of the Core Knowledge Phase courses. Students take this examination following successful completion of the Core Knowledge Phase course requirements. The exam is offered three times during the academic year. Students are allowed at most two attempts at this examination. Two failures result in dismissal from the graduate program. Possible grades on the Core Examination are Pass, Fail, and Distinction. Students who pass the Core Knowledge Examination with distinction and maintain a 3.75 grade point average graduate with distinction.

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 from 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 CTI. Elective courses are in the range of 420-699. Credit for courses taken outside of the school will only be given 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. No matter 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 578  Neural Networks I

LEVEL II
CSC 556  Foundations of Artificial Intelligence
CSC 579  Neural Networks II
CSC 582  Machine Learning
CSC 583  Natural Language Processing
CSC 585  Knowledge Representation
CSC 587  Cognitive Science
CSC 594  Topics in Artificial Intelligence

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 436  Foundations of Visual Computing
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 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 436  Foundations of Visual Computing
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, operation 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 the 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, and 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 Voice and Data Integration
TDC 568 Network Management

Systems Foundations Concentration is a concentration for students who desire current, advanced broad base technical work in computing technology. This is a flexible program 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 (formerly CSC 493)
CSC 448 Compiler Design

LEVEL II
CSC 503 Parallel Algorithms
CSC 504 Parallel Processing
CSC 535 Formal Semantics
CSC 544 Advanced Theoretical Computer Science (formerly CSC 490)
CSC 545 Advanced Computer Organization
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 550 Distributed Software Development
DS 513 Client/Server Technologies
IS 555 Design and Strategies for Internet Commerce
DS 520 Distributed Systems Practicum
DS 594 Distributed Systems Project
DS 599 Topics in Distributed Systems
Human-Computer Interaction Concentration

LEVEL I
HCI 400    Analysis and Design for HCI
HCI 410    Introduction to Human-Computer Interaction
HCI 430    Prototyping for Human-Computer Interaction I

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
IS 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 420    Software Design
SE 430    Object-Oriented Programming
SE 431    Formal Software Specifications and Development I
SE 450    Object-Oriented Software Development
SE 465    Software Engineering Principles

LEVEL II
SE 466    Software Engineering Projects
SE 480    Software Architecture
SE 531    Formal Software Specifications and Development II
SE 533    Software Validation and Verification
SE 550    Distributed Software Development

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 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 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, in 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 their 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.

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 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 offices 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. Students must complete the Prerequisite Phase before beginning the Core Knowledge Phase. However, while completing the Prerequisite Phase courses, students may take Core Knowledge Phase courses with consent of their faculty advisor. Fully admitted students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses prior to passing the Core Knowledge Examination. A student must receive a grade of C- or better in each of the Core Knowledge Phase courses, and also in subsequent courses in the degree program. 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 This examination covers the subject matter of the Core Knowledge Phase courses. Students take this examination following successful completion of the Core Knowledge Phase course requirements. The Core Knowledge Examination is offered three times during the academic year. Students are allowed at most two attempts at this examination. Two failures result in dismissal from the graduate program. Possible grades on the Core Knowledge Examination are Pass, Fail and Pass with Distinction. Students who pass the Core Knowledge Examination with distinction and maintain a 3.75 grade point average graduate with distinction.

The student must submit a written application three months before taking the Core Knowledge Examination. A student must finish the Prerequisite Phase in order to be eligible for the Core Exam. There is no charge for the Core Exam.

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 four courses:

CSC 449 Database Technologies
DS 520 Distributed Systems Practicum
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 513 Client/Server Technologies
DS 594 Distributed Systems Project
HCI 440 Introduction to Human-Computer Interaction
IS 512 Groupwave and Virtual Collaboration
IS 555 Design and Strategies for Internet Commerce
TDC 462 Data Communications

Three 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 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

The Human-Computer Interaction (HCI) master's degree program focuses on the rapidly growing discipline called human-computer interaction. 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.

PREREQUISITE PHASE

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

| ART 105 | Foundation Design |
| ART 260 | Graphic Design I |
| 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 |
| PSY 347 | Social Psychology |

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 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 offices 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.

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:

| ART 461 | Graphic Design II |
| HCI 400 | Analysis and Design for HCI |
| PSY 680 | Industrial and Organizational Psychology |
| PSY 443 | Psychology of Human Performance |
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 I
HCI 460  Evaluating Human-Computer Interaction

ADVANCED PHASE COURSES
Students must complete five 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 511  Designing for Disabilities
HCI 512  Designing for Visualization
HCI 513  Design and Strategies for Internet Commerce
HCI 590  Topics in Human-Computer Interaction

Computer Science
CSC 436  Foundations of Visual Computing
CSC 469  Computer Graphics I
CSC 470  Survey of Computer Graphics
CSC 539  Computer Graphics II
CSC 570  Visualization
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 their 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.

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

- **CSC 215**  Introduction to Structured Programming using C++ or
- **CSC 225**  C++ for Programmers
  (CSC 225 should only be taken by students with experience in programming languages)
- **CSC 240**  Personal Computing for Programmers
- **CSC 203**  COBOL Programming or
- **CSC 260**  Client Interface Programming
- **CSC 323**  Data Analysis and Statistical Software I
- **IS 404**  Business Fundamentals for IS
- **CSC 415**  Foundations of Computer Science 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 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 offices 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. Students must complete the Prerequisite Phase before beginning the Core Knowledge Phase. However, while completing the Prerequisite Phase courses, students may take Core Knowledge Phase courses with consent of their faculty advisor. Fully admitted students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses prior to passing the Core Knowledge Examination. A student must receive a grade of C- or better in each of the Core Knowledge Phase courses, and also in subsequent courses in the degree program. 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. This examination covers the subject matter of the Core Knowledge Phase courses. Students take this examination following successful completion of the Core Knowledge Phase course requirements. The Core Exam is offered three times during the academic year. Students are allowed at most two attempts at this examination. Two failures result in dismissal from the graduate program. Possible grades on the Core Exam are Pass, Fail and Pass with Distinction. Students who pass the Core Exam with distinction and maintain a 3.75 grade point average will graduate with distinction. The student must submit a written application three months before taking the Core Exam. A student must finish the Prerequisite Phase in order to be eligible for the Core Exam. There is no charge for the Core Exam.

ADVANCED PHASE

A student must complete 40 credits (10 courses) in the Advanced Phase to earn the MS in Information 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 three required courses, and take IS 577 after completion of the Core Knowledge Phase.

CSC 449 Database Systems
TDC 461 Basic Communications Systems
IS 577 Information Technology Policies and Strategies

Students must also complete three of the following courses:
IS 482 Legal Aspects of Data Processing
IS 511 Social Issues of Computing
IS 512 Groupware and Virtual Collaboration
IS 549 Data Warehousing and Data Mining
IS 553 Advanced Topics for System Development
IS 554 Information Engineering
IS 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 575 Information Retrieval
IS 578 Information Technology Consulting
IS 596 Topics in Information Systems
SE 430 Object-Oriented Modeling
CSC 457 Expert Systems
TDC 572 Network Security
IS 690 Research Seminar
IS 696 Master's Project
IS 698 Master's Thesis
Students must also choose two courses from one of the following areas in consultation with their faculty advisor:
Communications
Computer Vision/Graphics
Database Systems
Distributed Systems
Human-Computer Interaction
Software Engineering

Two elective courses must also be completed. 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 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 CASE 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 14 graduate courses, including a project or a thesis in an advanced area related to Software Engineering, and so develop their own personal area of expertise as part of completing this degree program. 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 includes a solid foundation in traditional computer science coursework together with advanced courses in Software Development, Distributed Systems, and Programming Languages.

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 complete a project or a thesis in an advanced area related to Software Engineering, and so develop their own personal area of expertise. Individual needs are addressed through elective courses chosen in consultation with a faculty advisor.

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.)
Prerequisites for Software Engineering continued:
CSC 315 Analysis and Design Techniques
CSC 323 Data Analysis and Statistical Software I
CSC 415 Foundations of Computer Science I
CSC 416 Foundations of Computer Science II
MAT 145 Calculus for Information Systems
(MAT 145 is equivalent to MAT 150, 151 Calculus I and II)

Also required for the Project Management Concentration:
One advanced computer science course chosen in consultation with a faculty advisor, for example, one of the following:
CSC 343 Introduction to Operating Systems
CSC 349 Databases and Data Management
TDC 361 Basic Communications Systems
CSC 417 Foundations of Computer Science III

Also required for the Software Development Concentration:
CSC 417 Foundations of Computer Science III

Also required for the Software Systems Concentration:
CSC 343 Introduction to Operating Systems
CSC 345 Computer Architecture
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 offices 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 14 courses (56 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 counselor to take other related advanced courses as substitutes.
- Completion of advanced courses.
- Successful completion of a project or successful defense of a thesis. Students who complete a project need to consult with an advisor before registering for SE 696 to discuss possible topics. Students who complete the thesis must first complete the course CSC 690 Research Seminar to develop a thesis proposal. They should choose a thesis advisor before the end of the first quarter following completion of their required courses and should also form a thesis committee, consisting of three faculty members, including the thesis advisor. They must write a thesis proposal and obtain approval of this proposal from their thesis committee before enrolling in the course CSC 698 Master's Thesis.
GRADUATE PHASE
Students may register for graduate courses only after meeting all Prerequisite Phase requirements. The Graduate Phase requirements are:

Project Management Concentration
Students must complete the following seven required courses:
CSC 423    Data Analysis and Regression
SE 430    Object-Oriented Modeling
SE 431    Formal Software Specifications and Development I
SE 450    Object-Oriented Software Development
SE 465    Software Engineering Principles
SE 468    Software Measurement and Project Estimation
SE 477    Software and System Project Management

Students must also complete four of the following courses. At least two of these must be from the software engineering department.

CSC 426    Values and Computer Technology
CSC 428    Data Analysis for Experimenters
CSC 447    Concepts of Programming Languages
CSC 449    Database Systems
HCI 440    Introduction to Human-Computer Interaction
SE 420    Object-Oriented Design
SE 427    Software Quality Management
SE 433    Software Testing
SE 455    Software Development Methods
SE 466    Software Engineering Projects
SE 467    Software Reliability
SE 469    Software Safety
SE 480    Software Architecture
SE 529    Software Risk Management
SE 531    Formal Software Specifications and Development II
SE 533    Software Validation and Verification
SE 550    Distributed Software Development
SE 558    Software Methodologies
SE 571    Software Maintenance
SE 590    Advanced Topics in Object-Oriented Technology
SE 690    Research Seminar

Student must also complete one of the following:
SE 696    Master's Project or
SE 690    Research Seminar
SE 698    Master's Thesis

Continuous enrollment in SE 699 Software Engineering Research Continuation is required after enrollment in SE 696/698 until the project/thesis is completed. Students who choose to complete CSC 698 Master's Thesis must first complete CSC 690 Research Seminar (which may count toward the advanced phase or elective requirement).

Students in the Project Management Concentration must also complete two elective courses. (See elective course restrictions below.)
**Software Development Concentration**

Students must complete the following seven required courses.

**SE 430** Object-Oriented Modeling
**SE 431** Formal Software Specifications and Development I
**SE 455** Software Development Methods
**SE 465** Software Engineering Principles
**SE 491** Software Engineering Studio
**SE 531** Formal Software Specifications and Development II
**SE 690** Research Seminar

Students must also complete four of the following courses. At least two of these must be software engineering.

**CSC 423** Data Analysis and Regression
**CSC 426** Values and Computer Technology
**CSC 428** Data Analysis for Experimenters
**CSC 447** Concepts of Programming Languages
**CSC 449** Database Systems
**HCI 440** Introduction to Human-Computer Interaction
**SE 420** Object-Oriented Design
**SE 427** Software Quality Management
**SE 433** Software Testing
**SE 450** Object-Oriented Software Development
**SE 466** Software Engineering Projects
**SE 467** Software Reliability
**SE 468** Software Measurement and Project Estimation
**SE 469** Software Safety
**SE 477** Software and System Project Management
**SE 480** Software Architecture
**SE 529** Software Risk Management
**SE 533** Software Validation and Verification
**SE 550** Distributed Software Development
**SE 558** Software Methodologies
**SE 571** Software Maintenance
**SE 590** Advanced Topics in Object-Oriented Technology

Student must also complete one of the following:

**SE 696** Master's Project or
**SE 698** Master's Thesis

Continuous enrollment in SE 699 Software Engineering Research Continuation is required after enrollment in SE 696/698 until the project/thesis is completed. Students who choose to complete CSC 698 Master's Thesis must first complete CSC 690 Research Seminar.

Students in the Software Development Concentration must also complete two elective courses. (See elective course restrictions below.)

**Software Systems Concentration**

Students must complete the following four required courses.

**CSC 447** Concepts of Programming Languages
**CSC 491** Design and Analysis of Algorithms
**SE 455** Software Development Methods
**SE 690** Research Seminar
Students must also choose one of the following programming language courses.

CSC 448  Compiler Design
CSC 535  Formal Semantics of Programming Languages
CSC 547  Advanced Topics in Programming Languages

Students must also choose one the following Distributed Systems courses.

DS 420  Foundations of Distributed Systems
SE 550  Distributed Software Development

Students must also choose three of the following software development courses.

SE 430  Object-Oriented Modeling
SE 431  Formal Software Specifications and Development I
SE 450  Object-Oriented Software Development
SE 465  Software Engineering Principles
SE 491  Software Engineering Studio

Student must also complete one of the following:

SE 696  Master's Project or
SE 698  Master's Thesis

Continuous enrollment in SE 699 Software Engineering Research Continuation is required after enrollment in SE 696/698 until the project/thesis is completed. Students who choose to complete CSC 698 Master's Thesis must first complete CSC 690 Research Seminar.

Students in the Software Systems Concentration 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 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 their 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.

**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.)
TELECOMMUNICATIONS SYSTEMS

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
(either 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 offices 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. Students must complete the Prerequisite Phase before beginning the Core Knowledge Phase. However, while completing the Prerequisite Phase courses, students may take Core Knowledge Phase courses with consent of their faculty advisor. Fully admitted students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses prior to passing the Core Knowledge Examination. A student must receive a grade of C- or better in each of the Core Knowledge Phase courses, and also in subsequent courses in the degree program. 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. A student must finish the Prerequisite Phase in order to be eligible for the Core Exam. Students take this exam following successful completion of the Core Knowledge Phase courses. The exam is offered three times during the academic year. Students are allowed at most two attempts at this examination. Two failures result in dismissal from the graduate program. Possible grades on the exam are Pass with Distinction, Pass, and Fail. Students who pass the exam with distinction and maintain a 3.75 grade point average will graduate with distinction. The student must submit an application three months prior to taking the exam. There is no charge for the exam.

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  Management of Information Technology
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 CII 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 their 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.

PREREQUISITE PHASE

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

- ACC 500 Financial Accounting
- MGT 502 Managing Operations for Competitive Advantage
- ACC 555 Management Accounting for Decision Making
- CSC 215 Introduction to Structured Programming using C++ or
- CSC 225 C++ for Programmers
  (CSC 225 should only be taken by students with experience in programming languages)
- CSC 240 Personal Computing for Programmers
- CSC 203 COBOL Programming or
- CSC 260 Client Interface Programming
- CSC 323 Data Analysis and Statistical Software I
- IS 404 Business Fundamentals for IS
- CSC 415 Foundations of Computer Science 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 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 offices 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. Students must complete the Prerequisite Phase before beginning the Core Knowledge Phase. However, while completing the Prerequisite Phase courses, students may take Core Knowledge Phase courses with consent of their faculty advisor. Fully admitted students in the Core Knowledge Phase may register for a maximum of four Advanced Phase courses prior to passing the Core Knowledge Examination. A student must receive a grade of C- or better in each of the Core Knowledge Phase courses, and also in subsequent courses in the degree program.

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. This examination covers the subject matter of the Core Knowledge Phase courses. Students take this examination following successful completion of the Core Knowledge Phase course requirements. The Core Knowledge Examination is offered three times during the academic year. Students are allowed at most two attempts at this examination. Two failures result in dismissal from the graduate program. Possible grades on the Core Knowledge Examination are Pass, Fail and Pass with Distinction. Students who pass the Core Knowledge Examination with distinction and maintain a 3.75 grade point average graduate with distinction.

The student must submit a written application three months before taking the Core Knowledge Examination. A student must finish the Prerequisite Phase in order to be eligible for the Core Exam. There is no charge for the Core Exam.

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 461 Basic Communications System
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.
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, students 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 their 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 Master's 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 may wish to do small research projects during this time period to explore where their 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 their 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 their 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 48 credits of courses in the 420-599 range, including CSC 426 Values and Computer Technology, 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, partici-
pation 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.


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 Candid-
  acy 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 Candid-
  acy and the dissertation defense.

Consult the Handbook for Graduate Studies at the back of this bulletin for graduation appli-
cation 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 260  
Graphic Design I. Introduction to graphic design. Projects enable proficiency in type, graphic images, color, and paper selection. **Prerequisite:** ART 105.

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 processing of large quantities of data.

CSC 215  
Introduction to Structured Programming Using C++. An introduction to structured computer programming using ANSI C++. Topics include: simple data types, control structures, character string processing, array processing, functions and structures. (Recommended: Students should have completed or be concurrently enrolled in MAT 140.)

CSC 225  
C++ for Programmers. Introduction to C++ for persons with previous programming experience in some high-level language other than C or C++. Basic input/output (e.g., cin, cout), variables, operators, control flow, functions, program structure, arrays, pointers, storage classes, type qualifiers, classes, constructors, 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 concepts 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:** 110 or 150.

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

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. **Prerequisite: CSC 416.**

CSC 345  *Computer Architecture.* Introduction to digital logic; microprogramming; further topics. **Prerequisite: CSC 415 or consent.**

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: 240.**

CSC 415  *Foundations of Computer Science I.* Iteration, induction, and recursion; asymptotic analysis; proofs of correctness; elementary combinatorics; sets; propositional logic; predicate logic. **Prerequisite: MAT 140 or equivalent.**

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.**

IS 404  *Business Fundamentals for IS.* Survey of business, accounting, marketing, and management concepts relevant to information systems professionals. Topics include financial accounting, managerial accounting, fundamentals of management, production and operations management. Open to IS graduate students. Others require consent of instructor.

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: MAT 140 or equivalent.**

MAT 140  *Discrete Mathematics I.* Boolean Algebra, graph theory, and combinatorial analysis with computer applications. **Prerequisite: 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 logarithm 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 151.**
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 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 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 consent.

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.

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 436  *Foundations of Visual Computing.* Mathematical and physical notions that underpin computer vision graphics. Topics will include approximation, interpolation, linear shift invariant systems, transforms for signal and analysis, radiant sources, photometry. **Prerequisite:** MAT 150, 151 or 145.

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.
CSC 447  **Concepts of Programming Languages.** Formal methods of syntactic specification of programming languages. Various semantic aspects of modern programming languages: scoping, binding, and parameter passing. Modularity and abstraction mechanisms of modern programming languages. Typing and polymorphism. Exception handling and concurrency. Declarative programming languages. Comparison of modern programming languages and paradigms. **Prerequisite: CSC 417.**

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 or consent.**

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 311 or 415.**

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. **Prerequisites: CSC 449, a programming language.**

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 449, 215.**

CSC 453  **Client/Server Database Application Development.** This course covers the following topics: differences between call 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 449 and CSC 260.**

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.

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 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 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:** one statistics course.

CSC 485 **Numerical Analysis.** Use of a digital computer for numerical computation. Error analysis, Gaussian elimination and Gauss-Seidel method, solution of nonlinear equations, function evaluation, approximation of integrals and derivatives, Monte Carlo methods. **Prerequisites:** MAT 220 and a programming course.


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 416 and 417 or instructor consent.

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 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 system, 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. **Prerequisites:** 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 556  **Foundations of Artificial Intelligence.** A survey of the fundamental techniques used in artificial intelligence. Heuristic search, game playing, means-ends analysis and classical planning, constraint propagation, natural language understanding, and systems that learn. An introduction to intelligent interfaces, intelligent agents, and modeling human cognition with AI systems. **Prerequisite:** CSC 456, CSC 457 or CSC 458 or consent.

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 578  **Neural Networks I.** 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 multi layer models, Hopfield nets, Boltzmann machines, and others. Some current applications are explored. **Prerequisite:** MAT 150, 151 or 145.

CSC 579  **Neural Networks II.** Advanced neural network architectures: Kohonen Networks, Counter Propagation Networks, Bi-directional Associative Memories as well as Art1 and Art2 Networks. Professional Neural Network development tools will be used throughout the course. There will be a project. **Prerequisite:** CSC 578 and MAT 150, 151 or 145.
CSC 580  *Artificial Intelligence Programming*. System implementation, using the powerful procedures and structures of modern AI such as: slot and filler databases, unification pattern matching, heuristic search, deductive information retrieval, procedures as data, case-based reasoning, natural language understanding, logic programming, discrete networks, and constraint satisfaction. **Prerequisite:** CSC 458.


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 or consent of instructor.

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 585  *Knowledge Representation*. Techniques for symbolic representation of knowledge in artificial intelligence and knowledge-based systems. Topics will include propositional logic, predicate calculus, nonmonotonic logics, semantic networks and frames, conceptual dependencies and scripts, truth maintenance systems, and qualitative reasoning. **Prerequisite:** CSC 456.

CSC 587  *Cognitive Science*. Introduction to the principles and methods of cognitive psychology, and the relation between psychology and artificial intelligence; in particular, the use of AI systems to model human cognition. An overview of AI systems that have been intended as cognitive models, such as ACT* and SOAR. Emphasis on information processing. Applications to human/computer interaction.

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:** consent of instructor. 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 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. Students may register for this course no more than twice. Prerequisite: consent of the instructor.

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 competencies 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:** CSC 416.

DS 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. **Prerequisite:** TDC 561, or SE 450.

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, Power Builder, and Visual C++. **Prerequisite:** DS 420, CSC 449.

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.**
HUMAN-COMPUTER INTERACTION COURSE OFFERINGS

Completion of the prerequisite competencies 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, 240, PSY 105.

**HCI 422 Multimedia.** Multimedia interface design. Underlying technological issues including synchronization and coordination of multiple media, 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.

**HCI 430 Prototyping for Human-Computer Interaction I.** 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 or permission of the instructor.

**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:** Consent, HCI 400, ART 461, PSY 680.

**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 prerequisites or permission.

**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 410 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 410 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 content organization, response time, usability testing. Authoring tools and administering web server. Internet database servicing 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 HCI 420, or advanced standing for other majors.
HCl 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. TAE+, Galaxy, DevGuide, C, C++, Tk/Tk. Students present their final results to the class. **Prerequisite:** CSC 417 or equivalent.

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

HCl 594  **Human-Computer Interaction Capstone.** HCl 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, JAD, work flow diagrams, entity-relationship diagrams, data flow diagrams, and object oriented modeling. **Prerequisite:** IS 404 and CSC 415.

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 IS 422 in consecutive quarters. **Prerequisite:** IS 421.

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.

IS 483  **Information Systems Management.** Concepts, tools and techniques for managing information systems operations and services. Topics include organization of information service functions; human resources management; capital and operating budgets; selection of hardware, software and vendor services; preparation of RFIs 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 CSC 415.
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:** CSC 415 and IS 422, or DS 420, or equivalents.

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. Introduction to data mining. **Prerequisite:** CSC 449.

IS 553  **Advanced Topics for System Development.** Planning and implementation of strategic 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, inter-organizational 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 servicing 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 sizes and approaches, including traditional life cycle and rapid development. **Prerequisite:** IS 422.

**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 CSC 449

**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 systems (DSS), group decision support systems (GSS), and executive information systems (EIS). Case studies, projects on applications, and evaluation of software. **Prerequisite:** CSC 449

**IS 575**  
*Information Retrieval.* Introduction to the design and analysis of computer-based information storage and retrieval systems. Retrieval systems using natural language, question-answering techniques and web crawler. Storage and retrieval of unstructured and well-structured data. On-line inventory systems and bibliographic search systems. **Prerequisite:** CSC 323 or consent.

**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 (organizational, industry, and governmental policy perspectives), end-user computing, outsourcing, theoretical models (e.g., Porter), 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 556.

**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 416.**

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.**

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 315.**

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: SE 465.**

SE 433  **Software Testing.** Software testing strategies. Designing test plans and test cases. Design reviews, walk throughs, and inspections. Configuration management. **Prerequisite: CSC 315.**

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 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 applications. 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.

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 315.

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 465.

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 and MAT 145.

SE 468 **Software Measurement and Project Estimation.** Software metrics. Productivity, effort and defect models. Software cost estimation. **Prerequisites:** CSC 423 and either SE 465 or IS 475.

SE 469 **Software Safety.** Managing safety, the safety process, hazard analysis models and techniques, designing for safety, verification of safety. **Prerequisite:** SE 465 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 IS 475.

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 430.
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, SE 465 or IS 475.

SE 531  **Formal Software Specifications and Development II.** Techniques for specifying software requirements using formal language. Model-base 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 465 or IS 475.

SE 550  **Distributed Software Development.** Fundamentals and techniques of developing distributed and concurrent applications using Java. Concepts and language constructs covered include: threads, synchronization, communication, remote method invocation. Focus on pattern-based approach to adress the problems in distributed and concurrent applications, including safety, liveness, state-dependent actions, and concurrency control. **Prerequisite:** SE 450.

SE 558  **Software Methodologies.** Recently developed techniques for software requirements analysis, specification, and design. **Prerequisite:** SE 465 or IS 475.

SE 571  **Software Maintenance.** Maintenance characteristics, tasks, side effects, issues and techniques. Management considerations. Productivity in the maintenance environment. Structured technologies and maintenance. **Prerequisite:** IS 421 or SE 465.

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

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 692  **Software Engineering Studio Continuation (1 credit hour).** Students register for continuation credit after registering for SE 491 in each subsequent quarter until they complete their studio project. Students who fail to do so will have to reregister for SE 491 to meet the requirement for completing that course. **Prerequisite:** SE 491.

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.
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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 reregister 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 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: TDC 411 or CSC 345, MAT 145, CSC 323.

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 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: Completion of the Core Phase.
TDC 512  **Cellular and Wireless Telecommunications.** An overview of cellular telephony including regulatory framework, RF design and frequency reuse, signaling and wireline 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 462, 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 a business perspective. Prerequisite: TDC 464. TDC 565 is recommended.

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

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 312-362-6282. 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.
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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 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.
COURSE DESCRIPTIONS

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 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, saving 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 Accounting 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 1 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.
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 1 or equivalent.**

Management Information Systems

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 1 and MIS 670 or equivalent.**

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.**

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.**

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.**
**Course Descriptions**

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.**
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

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.

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.

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 I or equivalent.

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.

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

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 555, MKT 555, and MKT 525 or equivalent.
THE UNIVERSITY

CAMPUSES

DePaul University has five locations. The Lincoln Park Campus is situated about three miles north of the Chicago Loop in the vicinity of Webster (2200 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 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, DesPlaines—just north of the intersection of River Road and Devon. The South Campus is located at South Suburban Community College's University and College Center, 16335 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 six different units: The Lincoln Park Library, the Naperville Campus Library, the O'Hare Campus Library, and the South 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. Holdings information for an additional 800 public, private, and academic libraries in Illinois can also be displayed. Materials from these and other libraries across the United States can 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 curriculum. The law collection includes United States federal and state court reports, codes, constitutions, and statutes; materials on health law, tax law and international human rights law; and legal periodicals. Designated an official depository for government publications, the Law Library provides a selective collection of federal documents.

The Naperville, O'Hare and South Campus Libraries offer an innovative approach to library service by providing access to information using computers and telecommunications. The Library's networked electronic information resources include access to ILLINET Online, and also provide access to periodical articles, business reports, indexes, an encyclopedia and other reference sources. The O'Hare and South Campus libraries have small, select print reference collections; the Naperville Campus Library has a more significant collection of print materials including journals and books. Books and other journal articles needed by students and faculty are delivered by a daily intra-university shuttle service.
ACADEMIC COMPUTING FACILITIES

Information Services (IS) provides facilities and resources to support instruction and research at DePaul University. DePaul's campus-wide network connects the Microcenters, computer classrooms and faculty offices on its six campuses to computing resources. These resources consist of three Sun SparcServers (Unix) and approximately 20 Novell Netware servers. The Microcenters offer Windows and Macintosh workstations, high-speed line printing and laser printing. They also offer access to the Internet through a variety of client applications. The computer classrooms have a computer for each student, and accommodate classes of 27 to 36 students. There are approximately 600 workstations in the Microcenters and computer classrooms throughout DePaul. Dial-in access is also available for students with DePaul Online accounts.

<table>
<thead>
<tr>
<th>LOOP CAMPUS</th>
<th>LINCOLN PARK CAMPUS</th>
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<tbody>
<tr>
<td>Computer Science &amp; Telecommunications Center 400</td>
<td>Schmidt Academic Center 235</td>
</tr>
<tr>
<td>243 South Wabash</td>
<td>2320 North Kenmore</td>
</tr>
<tr>
<td>(312) 362-8336</td>
<td>(773) 325-7000, x1097</td>
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<tr>
<td>60 Windows Workstations</td>
<td>115 Windows Workstations</td>
</tr>
<tr>
<td>Lewis Center 1420</td>
<td>23 Macintosh Workstations</td>
</tr>
<tr>
<td>25 East Jackson Boulevard</td>
<td>Byrne Hall 358</td>
</tr>
<tr>
<td>(312) 362-8593</td>
<td>2219 North Kenmore</td>
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<tr>
<td>50 Windows Workstations</td>
<td>(773) 325-7000, x1088</td>
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<tr>
<td>12 Macintosh Workstations</td>
<td>20 Windows Workstations</td>
</tr>
<tr>
<td>Computer Classrooms</td>
<td>McGaw Hall 145</td>
</tr>
<tr>
<td>Lewis Center 13th Floor</td>
<td>802 West Belden</td>
</tr>
<tr>
<td>25 East Jackson Boulevard</td>
<td>(773) 325-7000, x1096</td>
</tr>
<tr>
<td>(312) 362-8177</td>
<td>25 Windows Workstations</td>
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<tr>
<td>3 Classrooms</td>
<td>O'HARE CAMPUS</td>
</tr>
<tr>
<td>100 Windows Workstations</td>
<td>3166 River Road, Room 207</td>
</tr>
<tr>
<td>SOUTH CAMPUS</td>
<td>Des Plaines, IL</td>
</tr>
<tr>
<td>16333 South Kilbourn Road, Room 5004</td>
<td>(312) 362-7608</td>
</tr>
<tr>
<td>Oak Forest, IL</td>
<td>50 Windows Workstations</td>
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<tr>
<td>(708) 633-9093</td>
<td>NAPERVILLE CAMPUS</td>
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<tr>
<td>14 Windows Workstations</td>
<td>150 W. Warrenville Road</td>
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<tr>
<td>Lewis Center 1504</td>
<td>Naperville, IL</td>
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<tr>
<td>25 East Jackson Boulevard</td>
<td>(312) 362-6481</td>
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<tr>
<td>(312) 362-8765</td>
<td>20 Windows Workstations</td>
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<tr>
<td>Schmidt Academic Center 230</td>
<td>Schmidt Academic Center 230</td>
</tr>
<tr>
<td>2320 North Kenmore Avenue</td>
<td>(312) 362-8765</td>
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</tbody>
</table>

Students, faculty and staff have access to a variety of applications in the Microcenters, and these are used extensively throughout the DePaul curriculum. IS also offers seminars and workshops on various topics. Brochures listing the workshops and hours of operation are available at all of the above sites.

CAREER DEVELOPMENT

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 Schmidt 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
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THE NATIONAL LEAGUE OF NURSING

DEPAUL IS ON THE APPROVED LIST OF

THE AMERICAN BAR ASSOCIATION
THE ILLINOIS BOARD OF HIGHER EDUCATION
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DEPAUL UNIVERSITY IS A MEMBER OF

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THE ASSOCIATION OF CATHOLIC COLLEGES AND UNIVERSITIES
THE ASSOCIATION OF GOVERNING BOARDS OF UNIVERSITIES AND COLLEGES
**HANDBOOK FOR GRADUATE STUDIES**

- The Chicagoland Advocates for Signed Theatre
- The Consortium of Conservatory Programs
- The Council for Adult and Experiential Learning
- The Council of Graduate Schools
- The Federation of Independent Illinois Colleges and Universities
- The Illinois Arts Alliance
- The Illinois League for Nursing
- The International Association of Theatre for Children and Young People
- The League of Chicago Theatres
- The Midwest Alliance in Nursing
- The National Association of Independent Colleges and Universities
- The National Catholic Education Association
- The National Council of Educational Opportunity Associations
- The National Council on Rehabilitation Education

**HONOR SOCIETIES**

<table>
<thead>
<tr>
<th>Honor Society</th>
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<tr>
<td>Alpha Lambda Delta</td>
<td>Phi Delta Kappa</td>
</tr>
<tr>
<td>Beta Alpha Psi</td>
<td>Phi Kappa Delta</td>
</tr>
<tr>
<td>Beta Gamma Sigma</td>
<td>Phi Kappa Phi</td>
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<tr>
<td>Delta Mu Delta</td>
<td>Pi Kappa Lambda</td>
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<tr>
<td>Delta Sigma Pi</td>
<td>Pi Sigma Alpha</td>
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<tr>
<td>Golden Key National Honor Society</td>
<td>Psi Chi</td>
</tr>
<tr>
<td>Omicron Delta Epsilon</td>
<td>Sigma Delta Pi</td>
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<tr>
<td>Order of the Coif</td>
<td>Sigma Pi Sigma</td>
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<tr>
<td>Phi Alpha Delta</td>
<td>Sigma Theta Tau</td>
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<tr>
<td>Phi Alpha Theta</td>
<td>Sigma Xi</td>
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<tr>
<td>Phi Beta Delta</td>
<td>Theta Alpha Kappa</td>
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</tbody>
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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, or 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 $10.00 per copy, to be submitted along with the copies of the thesis. The date for filing is published in the current Bulletin and the class schedule or may be obtained directly from the School office. The responsibility 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 complete 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 confers, is offered by the School of Computer Science, Telecommunications and Information 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 knowledge 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 limitations. Additional requirements are stated in the program section 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 determination 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 allied 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 scholastic 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 examination, the chair of the committee sends a report of 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 firm information. The University reserves the right to revise the content of its Bulletins and Schedules, and to change policies, programs, requirements, rules, regulations, procedures, calendars and schedule of tuition and fees; to establish and modify admission and registration criteria; to cancel or change courses or programs and their content and prerequisites; to limit and restrict enrollment; to cancel, divide or change time or location or staffing of 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 insure 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 on 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>
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</tr>
<tr>
<td>B+</td>
<td>3.3</td>
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</tr>
<tr>
<td>B</td>
<td>3</td>
<td>4</td>
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</tr>
<tr>
<td>B-</td>
<td>2.7</td>
<td>4</td>
<td>10.8</td>
</tr>
<tr>
<td>C+</td>
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</tr>
<tr>
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</tr>
<tr>
<td>W, IN, R</td>
<td>Quality Points not assigned.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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, master’s 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

Conferred 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 its charges as conditions require.

Tuition and fees for services and materials are for the academic year 1997-98 are applicable only to graduate students.

GRADUATE STUDENT TUITION, PER QUARTER HOUR
Computer Science, Telecommunications and Information Systems
100-200 series, per hour ........................................... $285.00
300-700 series, per hour ........................................... 380.00

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 ........................................... 75.00
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 “Not Sufficient Funds,” “Payment Stopped,” or “Account Closed,” a $25.00 charge will be assessed for each such occurrence.

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 Lewis 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 98-99 academic year are:

- **Friday, September 4, 1998—Fall Quarter**
- **Friday, December 11, 1998—Winter Quarter**
- **Friday, March 19, 1999—Spring Quarter**
- **Friday, June 11, 1999—Summer I**
- **Friday, July 16, 1999—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 immediately. 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 NROL 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 accrued 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 and presently is 7.66 percent. It is adjusted annually on July 1. However, the interest rate 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>
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<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 (DePUPP) is a budget payment option which allows students to pay their tuition, fees, and room and board in monthly installments over a nine month period. This service is available to all DePaul University students. It is not a loan program, there are no interest or finance changes, or credit or financial-needs requirements.

The student determines the budget amount for the plan. DePUPP 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 15th 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 15th, 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 1. Applications made after this date must be accompanied by any past due payments to catch up to the regular schedule.

Applications received after September 1st but prior to October 1st 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 15th, and the last payment due March 15th.
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 $30.00 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 Students 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 any time the student falls delinquent in payment, the payment plan privilege is no longer available.

Eligible Courses. To be eligible to participate in this program, students must be enrolled in the traditional quarterly courses which are 10 weeks in duration (5-week 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 cannot apply 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 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 and 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.

<table>
<thead>
<tr>
<th>Term</th>
<th>Application Deadline Date</th>
<th>Extended Payment Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall, Winter, Spring (one time application)</td>
<td>Friday, August 28, 1998</td>
<td>January 15, 1999</td>
</tr>
<tr>
<td>Fall quarter</td>
<td>Friday, August 28, 1998</td>
<td>April 16, 1999</td>
</tr>
<tr>
<td>Winter quarter</td>
<td>Friday, December 4, 1998</td>
<td>July 9, 1999</td>
</tr>
<tr>
<td>Spring quarter</td>
<td>Friday, March 12, 1999</td>
<td>September 10, 1999</td>
</tr>
<tr>
<td>Summer Session I</td>
<td>Friday, June 4, 1999</td>
<td>October 8, 1999</td>
</tr>
<tr>
<td>Summer Session II</td>
<td>Friday, July 9, 1999</td>
<td></td>
</tr>
</tbody>
</table>

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, include the TERI PEP Loan and the Nellie 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

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 7</td>
<td>Monday: Labor Day.</td>
</tr>
<tr>
<td>September 4</td>
<td>Friday: Autumn tuition payment due.</td>
</tr>
<tr>
<td>September 9</td>
<td>Wednesday: Autumn quarter evening classes begin.</td>
</tr>
<tr>
<td>October 7-13</td>
<td>Wednesday - Thursday: Mid-term week (optional).</td>
</tr>
<tr>
<td>October 30</td>
<td>Friday: Last day to withdraw from classes.</td>
</tr>
<tr>
<td>November 17</td>
<td>Tuesday: Last day of Autumn quarter evening classes.</td>
</tr>
<tr>
<td>November 18-24</td>
<td>Wednesday - Tuesday: Final examinations for Autumn quarter evening classes.</td>
</tr>
<tr>
<td>November 25</td>
<td>Wednesday: End of Autumn quarter.</td>
</tr>
<tr>
<td>November 25-28</td>
<td>Wednesday Evening - Sunday: Thanksgiving holiday.</td>
</tr>
<tr>
<td>December 11</td>
<td>Friday: Winter tuition payment due.</td>
</tr>
</tbody>
</table>

### Winter Quarter

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 4</td>
<td>Monday: Winter quarter evening classes begin.</td>
</tr>
<tr>
<td>February 2-8</td>
<td>Tuesday-Monday: Mid-term week (optional).</td>
</tr>
<tr>
<td>February 19</td>
<td>Friday: Last day to withdraw from classes.</td>
</tr>
<tr>
<td>March 12</td>
<td>Friday: Last day of Winter quarter evening classes.</td>
</tr>
<tr>
<td>March 15-20</td>
<td>Monday-Saturday: Final examinations for Winter quarter classes.</td>
</tr>
<tr>
<td>March 19</td>
<td>Friday: Spring tuition payment due.</td>
</tr>
<tr>
<td>March 20</td>
<td>Saturday: End of Winter Quarter.</td>
</tr>
</tbody>
</table>

### Spring Quarter

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 27</td>
<td>Saturday: Spring quarter Saturday classes begin.</td>
</tr>
<tr>
<td>March 29</td>
<td>Monday: Spring quarter classes begin.</td>
</tr>
<tr>
<td>April 2-4</td>
<td>Friday - Sunday: Easter holiday — no classes.</td>
</tr>
<tr>
<td>April 26-May 30</td>
<td>Monday - Friday: Mid-term week (optional).</td>
</tr>
<tr>
<td>May 14</td>
<td>Friday: Last day to withdraw from classes.</td>
</tr>
<tr>
<td>May 31</td>
<td>Monday: Memorial Day holiday — no classes.</td>
</tr>
<tr>
<td>June 4</td>
<td>Friday: Last day of Spring quarter classes.</td>
</tr>
<tr>
<td>June 5-11</td>
<td>Saturday-Friday: Final examinations for Spring quarter classes.</td>
</tr>
<tr>
<td>June 11</td>
<td>Friday: Spring quarter ends. Summer I tuition payment due.</td>
</tr>
<tr>
<td>June 12-13</td>
<td>Saturday-Sunday: Commencement.</td>
</tr>
</tbody>
</table>

### Summer Sessions

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 14</td>
<td>Monday: Summer Session I begins.</td>
</tr>
<tr>
<td>July 16</td>
<td>Friday: Summer Session I ends.</td>
</tr>
<tr>
<td>July 19</td>
<td>Friday: Summer Session II tuition payment date.</td>
</tr>
<tr>
<td>July 21</td>
<td>Wednesday: Summer Session II begins.</td>
</tr>
<tr>
<td>August 24</td>
<td>Tuesday: Summer Session II ends.</td>
</tr>
</tbody>
</table>