

2004 - 2005

DEPAUL UNIVERSITY COURSE CATALOG

SCHOOL OF COMPUTER SCIENCE,

TELECOMMUNICATIONS AND

INFORMATION SYSTEMS

GRADUATE PROGRAMS

SCHOOL OF COMPUTER SCIENCE, TELECOMMUNICATIONS AND INFORMATION SYSTEMS

ADMINISTRATION

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Director, Institute for Professional Development

Assistant Dean

PHILOSOPHY

FACULTY

PURPOSES

FACILITIES

ADMISSION

PROGRAMS

DOCTOR OF PHILOSOPHY

Computer Science

MASTER OF ARTS

Applied Technology

Information Technology

MASTER OF SCIENCE

Business Information Technology

Computer Graphics and Animation

Computer, Information and Network Security

Computer Science

Distributed Systems

E-Commerce Technology

Human-Computer Interaction

Information Systems

Instructional Technology Systems

Software Engineering

Telecommunication Systems

JURIS DOCTORATE AND MASTER OF ARTS

JURIS DOCTORATE AND MASTER OF SCIENCE

CONTINUING EDUCATION PROGRAMS

Advanced Software Development Professional

COURSES

To obtain a Course Catalog for the Kellstadt Graduate School of Business call (312) 362-8810, for the College of Law call (312) 362-8701, or for Graduate Programs call (312) 362-5367.

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DePaul University does not discriminate on the basis of race, color, national origin, religion, gender, sexual orientation, age, or handicap in admissions, employment, or the provision of services. Inquiries regarding this policy should be addressed to the Director of Human Resources, DePaul University, 25 E. Jackson Boulevard, Chicago, Illinois 60604. Editor: John Glatz

Note: The University reserves the right to revise its Course Catalogs and Schedules.

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Master of Science in Distributed Systems

Master of Science in E-Commerce Technology

Master of Science in Human-Computer Interaction

Master of Science in Information Systems

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STATEMENT OF VINCENTIAN CHARACTER

CAMPUS LOCATIONS

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

LINCOLN PARK CAMPUS

2320 North Kenmore Avenue
Chicago, Illinois 60614

LOOP CAMPUS

243 South Wabash
Chicago, Illinois 60604
312-362-8381
(full program of course offerings)

BARAT CAMPUS

700 East Westleigh Drive
Lake Forest, Illinois 60045
(selected course offerings)

LAKE FOREST CAMPUS

150 Field Drive
Lake Forest, Illinois 60045
(selected course offerings)

NAPERVILLE CAMPUS

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

O'HARE CAMPUS

3166 River Road
Des Plaines, Illinois 60018
(selected course offerings)

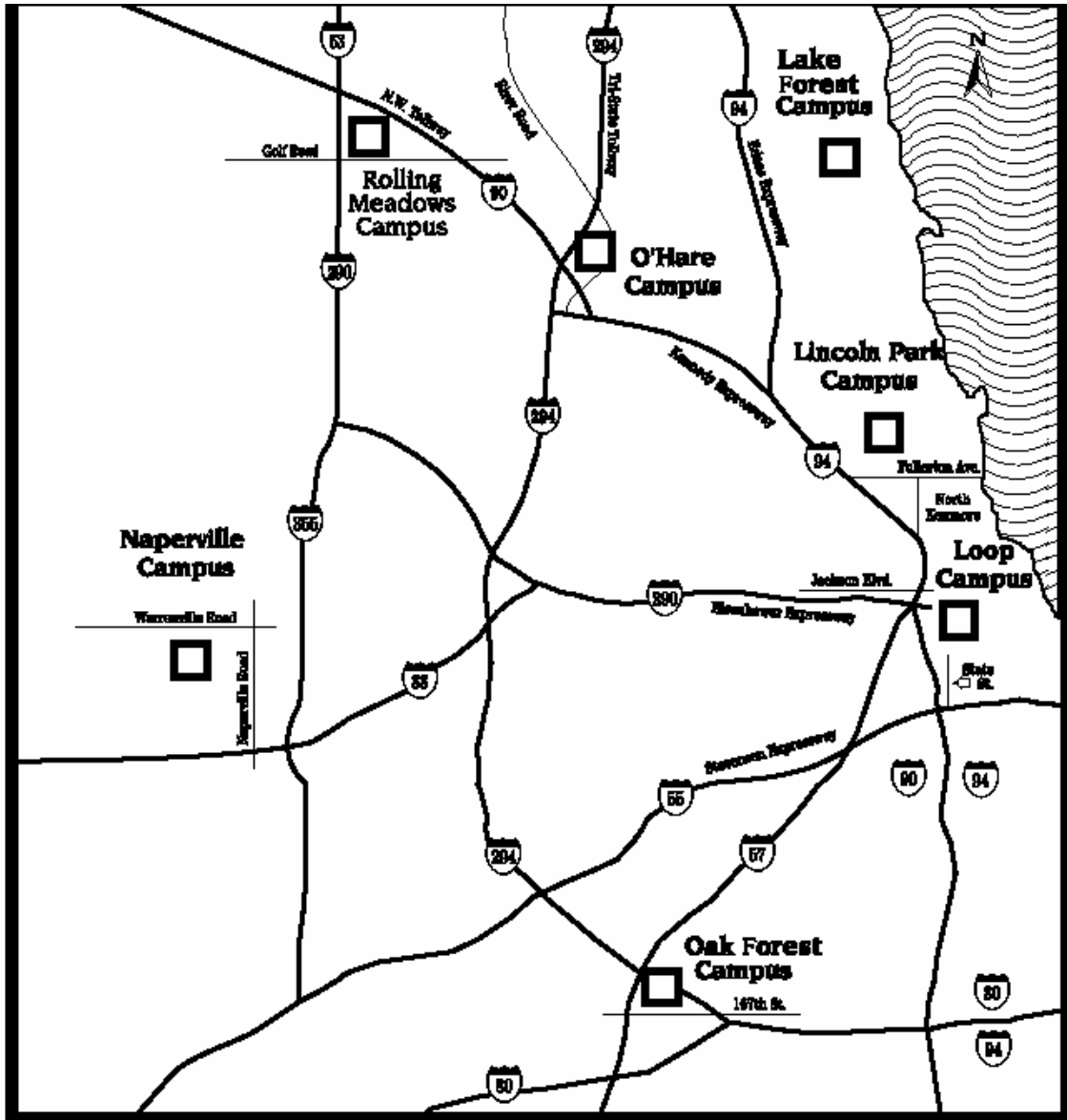
ROLLING MEADOWS CAMPUS

2550 West Golf Road

Meadows Corporate Center, East Tower
Rolling Meadows, Illinois 60
(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 suburban campuses, most students will be able to take increasing advantage of these locations.

CAMPUS MAP



PHILOSOPHY

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

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

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

FACULTY

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Northwestern University

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Illinois Institute of Technology

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Syracuse University

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DePaul University

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University of Chicago

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Massachusetts Institute of Technology

ERIC SEDGWICK, PH.D.,
Associate Professor
University of Texas

RAFFAELLA SETTIMI, PH.D.,
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AMBER SETTLE, PH.D.,
Associate Professor
University of Chicago

PAUL SISUL, M.DIV.,
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Assistant Professor
Purdue University

LU ZHANG, PH.D.,
Assistant Professor
Iowa State University

PURPOSES

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

FACILITIES

DePaul's Information System 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 SLIP connections.

The School itself operates specialized laboratories in the following:

- Requirements Engineering Lab
- Mobile E-Commerce Lab
- Solid Objects Lab
- Software Research Lab
- Multimedia Networking Lab
- Artificial Intelligence Lab
- American Sign Language Lab
- E-Commerce Technology Lab
- Information Systems Lab

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 AND READMISSION PROCEDURES

Procedures for admission to the School of CTI involve submission of a completed application form and supporting credentials, payment of admission fee, observance of deadlines and receipt of the Dean's admission letter.

Applications may be submitted online at <http://www.cs.depaul.edu>

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

Application deadlines for MS applicants are:

August 1 for Autumn Quarter

November 15 for Winter Quarter

March 1 for Spring Quarter

May 1 for Summer Quarter

Students educated and residing outside the United States must submit an application and all supporting credentials no later than:

June 1 for Autumn Quarter

October 1 for Winter Quarter

January 1 for Spring Quarter

April 1 for Summer Quarter

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

NOTE: Programs may require additional supporting credentials. Please consult the specific programs listed on this website 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. This fee is nonrefundable. The applicant's full name must appear on the check or money order.

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

INTERNATIONAL STUDENT ADMISSION

The admission requirements stated above also apply to international students. Applicants educated outside of the United States must meet academic requirements and demonstrate English proficiency with a TOEFL score of 550 or greater (580 or greater for Ph.D. applicants). Those requesting student visas (I-20) must demonstrate adequate financial support. The letter of admission and the I-20 form are issued only after admission. Please visit our web site at <http://www.cs.depaul.edu> for further details about I-20s.

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

READMISSION PROCEDURES

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

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

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 waiver. (See Reclassification Procedures below.) 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 successfully pursue 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, as well as fulfillment of all program-specific prerequisite phase requirements.

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 nonrefundable.

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.

In addition, non-degree seeking students will not have access to enroll in courses numbered 420 and higher on their own. They must seek approval from the instructors of the courses in which they wish to enroll. The enrollment transaction will be processed by the advising office at the request of the instructor.

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 school 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.

RECLASSIFICATION PROCEDURES

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

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. Should an approval be granted, students are allowed to transfer a maximum of two graduate level courses. Additionally, these courses cannot have been used in the attainment of a previous degree.

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 an official score report of the Graduate Record Examination (GRE).

Applicants educated outside of the United States must demonstrate English proficiency with a TOEFL score of 580 or greater. A Ph.D. Admissions Committee determines which applicants will be admitted to the program. Because the School may only admit a limited number of students to the program, meeting the admission standards does not guarantee acceptance. Detailed program specifications can be found in the Ph.D. program section.

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 purposefully 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
- Inquiry Phase
- Research Phase
- Candidacy Phase
- Detailed Degree Requirements
-

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 three Breadth Examinations.
- **Research Phase:**
Focused research leading to successful completion of 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.

Three Breadth Examinations must be successfully completed. At least one of the 3 breadth exams must be in one of the core areas of computer science, namely, Artificial Intelligence, Database Systems, Operating Systems, Programming Languages, and Theoretical Computer Science. Furthermore, at least one breadth exam must be in the student's primary area of dissertation research. The choice of breadth exams must be approved by the student's PhD advisor. 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 must pass all three breadth exams with at most one re-take opportunity per exam. Re-takes of breadth exams must be approved by the PhD Committee.

A Ph.D. student enters the Research Phase when he or she has chosen an area in which to do dissertation research and has found a faculty member willing to act as his or her Dissertation Advisor. The amount of time spent in the Inquiry Phase will vary from student to student, but will typically be several years. The research phase may overlap with the inquiry phase, in fact, students are strongly encouraged to begin their research, under the supervision of a faculty PhD advisor, as early as possible upon entering the program.

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.

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. The dissertation committee may require additional components in conjunction with proposal defense to test the student's depth of knowledge in the specific area of dissertation research.

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, participation in seminars, or research performed off campus.

Allied Course: Complete CSC 426 Values and Computer Technology.

Doctoral Examinations: Pass three Breadth Examinations.

Defense of Proposal: Successfully defend a Dissertation Proposal.

Doctoral Examinations

Breadth examinations are typically offered twice each year. Applications to take these exams must be completed three months prior to the exam date. At least one of the 3 breadth exams must be in one of the core areas of computer science, namely, Artificial Intelligence, Database Systems, Operating Systems, Programming Languages, and Theoretical Computer Science. Furthermore, at least one breadth exam must be in the student's primary area of dissertation research. The choice of breadth exams must be approved by the student's PhD advisor. Must pass all three breadth exams with at most one re-take opportunity per exam. Requests to re-take one or more breadth exams must be approved by the PhD Committee. Any student who fails to satisfy the breadth exam requirements 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
- E-commerce Technology
- 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 Examinations.

No more than two years between completion of Breadth Examinations and admission to Candidacy.

No less than eight months and no more than five years between admission to Candidacy and the dissertation defense.

For full-time doctoral students, time limits are as follows:

No more than three years between admission to the doctoral program and completion of Breadth Examinations.

No more than two years between completion of Breadth Examinations and admission to Candidacy.

No less than eight months and no more than five years between admission to Candidacy and the dissertation defense.

Consult the Handbook for Graduate Studies at the back of this bulletin for graduation application deadlines and the deadline for submitting completed dissertations.

ARTS IN APPLIED TECHNOLOGY

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

The curriculum consists of three primary components:

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

This degree is administered by the School for New Learning. Please see their catalog entry for current requirements.

ARTS IN INFORMATION TECHNOLOGY



his program is intended for to prepare professionals in the broad field of Information Technology. In particular, the program prepares graduates interact professionally with technologists, write about IT, manage impacts of IT on organizations or society, or evaluate IT-oriented data.

This program may be appropriate for individuals in sales, management, marketing, journalism, law, or other professions who need to interact closely with IT specialists and technicians without being an IT specialist or technician. The program also is suited for managers of IT staff. For example, a large telecommunications company may have a non-technical sales manager for a technical sales force whose customers are also technically oriented. The goal of the MA in Information Technology program is to prepare someone like the non-technical sales manager to interact effectively with the technical sales force and the technical customers

Students who complete this program will acquire an understanding of and experience with:

- The concepts, tools, and practices of information technology management (IS 425)
- The analysis phase of the software development life cycle (HCI 445).
- The fundamentals of networks for voice and data communications and for the integration of voice and data streams (TDC 460).
- The methods and problems associated with technology-triggered business transformation (IS 450).
- The basics of database design. (CSC451)
- The fundamentals of project management for software systems (IS 556 or SE 447).
- The skills to acquire and analyze data (HCI 445 and CSC 423).

- **Prerequisite Phase**
- **Foundation Phase**
- **Advanced Phase**
- **Culminating Thesis**

Prerequisite Phase

The courses in the Prerequisite Phase for the MA in Information Technology are:

IT 140 Visual Communication Using Information Technologies

IT 230 Building Internet Applications

IT 263 Applied Networks and Security

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 Foundation 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 Foundation Phase of the program. Students may submit the Change of Status request by logging in to MyCTI.

Grade and GPA requirements

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

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.90 will graduate with distinction.

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

Foundation Phase

Fully admitted students in the Foundation Phase may register of a maximum of four Advanced phase courses. The Foundation Phase courses for the MA in Information Technology are:

CSC 423 Data Analysis and Regression
IS 425 Enterprise Information
HCI 445 Analysis and Design for HCI
CSC 451 Database Design
IS 511 Social Issues of Computing
IS 556 Project Management
ECT 455 E-Commerce Web Site Engineering

Advanced Phase

The advanced phase provides opportunities for breadth and depth in IT, and allows for specialized interests through five elective courses. Two of the five elective courses must be taken at the 500 level.

Possible advanced elective courses:

CSC 424 Advanced Data Analysis
CSC 428 Data Analysis for Experimenters
CSC 449 Database Technologies
IS 450 Enterprise System Implementation
IS 456 Knowledge Management Systems
IS 482 Legal Aspects of Information Technology
IS 483 Information Services and Operations
IS 505 Business Continuity and Disaster Recovery
IS 512 Groupware and Virtual Collaboration
IS 540 Global Information Technology
IS 560 Enterprise Systems
IS 572 Information Security Management
IS 577 Information Systems Capstone
IS 578 Information Technology Consulting
ECT 480 Intranets and Portals
ECT 556 Enterprise Architecture and Design
ECT 565 Mobile Enterprise
ECT 585 Legal Aspects of E-Commerce
ECT 586 Customer Relationship Management Technologies
ECT 589 E-Commerce Technology Capstone
HCI 450 Foundations of Human-Computer Interaction
HCI 460 Usability Evaluation Methods
HCI 560 Information Technology Training and User Support
SE 430 Object Oriented Modeling
TDC 463 Computer Networks and Data Systems
TDC 464 Voice Communication Networks
TDC 476 Economics of Telecommunication Systems
TDC 511 Telecommunications Practicum
TDC 569 Telecommunication Regulation, Policy,law and Standards
Culminating Thesis

The Culminating Thesis is an independent research article that demonstrates a student's ability to integrate both technical expertise and IT domain knowledge. Normally, it is undertaken during the student's final year in the MA program.

In this work, the student is guided and assessed by a Thesis supervisor. The thesis must represent an original contribution, and may include system evaluation, empirical studies, or theoretical work. The scope and the details of the research project will be determined by the supervisor, and must be approved by the student's academic advisor.

IT 698 Masters Thesis is a two-credit hour course. Students must register for this course a minimum of two times and must continue to enroll in the course in every quarter after the first quarter until the thesis is completed to the satisfaction of their supervisor. A maximum of four credit hours will apply for degree credit.

BUSINESS INFORMATION TECHNOLOGY

The Master of Science in Business Information Technology is a joint degree between School of Computer Science, Telecommunications and Information Systems (CTI) and the Kellstadt Graduate School of Business (KGSB). The program addresses today's need for individuals who understand the core principles of both business and technology in corporations, health care institutions, and government agencies. Many of these people work as liaisons between the Information Technology department and a functional business unit. Others work within departments that are information dependent and rely heavily on information technology. The M.S. in Business Information Technology also provides a solid base for those interested in moving their career forward through project management or information technology management positions.

Admissions

Students are admitted to the MS in Business Information Technology throughout the year. Applicants must choose to apply through only one of the two schools. Students applying through the school of CTI must possess a bachelor's degree from a regionally accredited institution (or be in the final stages of completing the undergraduate degree). The primary criterion in determining eligibility for admission is previous academic achievement. Other factors, such as work experience and career progression, are also important and will be considered for admission. Thus, although not required, applicants may wish to include letters of recommendation, a resume and other supporting material which they feel may give an Admissions officer a broader view of their achievements. International students are required to submit a recent (no more than two years old) TOEFL score. Please go to <https://www.cs.depaul.edu/admissions/requirements.asp> to review application requirements and https://www.cs.depaul.edu/CTI/gradapp/appmain_right1.asp to apply online.

This masters program does not require an admissions test. Please note that if you choose to apply through the Kellstadt School of Business, you will be required to submit a GMAT score.

Degree Program Courses

There is a single prerequisite course, IT 130 The Internet and the Web, which can be waived based on discussion with a CTI or KGSB advisor.

Required Courses (10)

Courses (5) from the Kellstadt Graduate School of Business

ACC 500 Financial Accounting
MGT 502 Managing Operations for Competitive Advantage
MIS 555 Management of Information Technology
MIS 674 Systems Analysis and Design
MKT 555 Decisions in Marketing Management

Courses (5) from the School of CTI

CSC 451 Database Design
IS 572 Information Security Management
IT 430 Building Internet Applications
SE 477 Software and Systems Project Management
TDC 425 Voice/Data Network Fundamentals

Electives (3)

Three electives, with one chosen from the business school, one chosen from the School of CTI, and one chosen from either the business school or from CTI:

Business school courses available for use as electives: (choose 1)

MIS 680 Electronic Business
MIS 681 E-Business Strategies
MIS 683 Information Technology Strategy and Architecture
MIS 689 Knowledge Management
MIS 798 Special Topics
MIS 799 Independent Study

CTI courses available for use as electives: (choose 1)

CSC 599 Topics in Computer Science
ECT 596 Topics in E-Commerce Technology
HCI 440 Usability Engineering
IS 450 Enterprise System Implementation
IS 511 Social Issues of Computing
IS 512 Groupware and Virtual Collaboration
IS 540 Global Information Technology
IS 574 Decision Support Systems and Intelligent Systems
IS 578 Information Technology Consulting
IS 596 Topics in Information Systems
SE 427 Software Quality Management
TDC 463 Computer Networks and Data Systems

Grade and GPA requirements

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

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.75 or higher and a designation of distinction on at least two core examinations and no failed core examination will graduate with distinction.

COMPUTER GRAPHICS AND ANIMATION

The M.S. in Computer Graphics and Animation is a study of the technical and aesthetic foundations, design and development of Computer Graphics. This program prepares students for technical careers in the graphics industry. Several fundamental principles provide the basis for this curriculum:

- Computer graphics professionals, no matter their area of specialty, will need a solid grounding in both perception and technology.
- To be successful in the workplace, computer graphics professionals will need to be able to work well in multidisciplinary environments.
- To inculcate the flexibility required to adapt to rapid changes in technology and industry norms, students will need to be well versed in the foundations of the discipline.
- Practical experience must be coupled with theory to prepare students for the workplace.

The degree has five components:

- **Prerequisite Phase**
- **Fundamental Phase**
- **Core Phase**
- **Advanced Phase**
- **Electives**

In this program, students will:

- Develop a sensitivity to human perception, including a comprehension of fundamental design concepts, color theory, and the interaction of light with surfaces;
- Build a deep understanding of such technical concepts as interaction design, modeling objects, controlling cameras, rigging characters for animation and using particle and surface techniques;
- Learn to apply perceptual and technical abilities in creating shaders, textures, characters, scenes and animations;
- Acquire hands-on experience with a wide range of commercially-available tools;
- Develop a grasp of fundamentals that allow implementations beyond the extant user interfaces; and
- Become appreciative of the two “cultures” of computer graphics – the one drawing on communication design and the other deriving from computer science.
- The degree program offers two concentrations: a Technical Director concentration and a Developer concentration. While both concentrations have a balance of technical and aesthetic, the Technical Director will have a greater emphasis on the aesthetic while the Developer concentration will focus on the technical. After graduation, Technical Directors will be ready for jobs assisting Creative Directors in such activities as creating virtual sets, adjusting lighting and rigging characters for animation. Developers will learn technologies for graphics systems development, including game engines and plug-ins.

The degree program offers two concentrations: a Technical Director concentration and a Developer concentration. While both concentrations have a balance of technical and aesthetic, the Technical Director will have a greater emphasis on the aesthetic while the Developer concentration will focus on the technical. After graduation, Technical Directors will be ready for jobs assisting Creative Directors in such activities as creating virtual sets, adjusting lighting and rigging characters for animation. Developers will learn technologies for graphics systems development, including game engines and plug-ins.

The M.S. in Computer Graphics program consists of 13 courses with six or seven prerequisite courses. Students choosing the Technical Director concentration take six courses while students taking the Developer concentration take seven courses.

Grade and GPA requirements

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

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.85 or higher will graduate with distinction.

Prerequisite Phase

The courses in the Prerequisite Phase for the MS in Computer Graphics and Animation are:

Both concentrations

HCI 402 Foundations of Digital Design
GPH 212 Perceptual Principles for Digital Environments II
IT 240 Introduction to Desktop Databases

Technical Director concentration *

CSC 211 Programming in Java I
CSC 212 Programming in Java II
 or CSC 224 Java for Programmers
 or CSC 396 Programming in Java I and II
GPH 259 Design Geometry

The CGA developer Track.

CSC 261 Programming Languages I: C/C++
CSC 262 Programming Languages II: C/C++
CSC 393 Data Structures in C++
MAT 150 Calculus I

*The Technical Director prerequisite track requires two quarters of programming in either Java or C/C++ so students entering with prior coursework in C++ will satisfy this requirement. Any TD student who wishes to eventually take courses in the Developer track as electives are encouraged to take the C++ programming track CSC 261 and CSC 262 to satisfy their prerequisite programming requirement.

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 Foundation Phase courses prior to completing their prerequisites. The student must submit an online Change of Status request when the Prerequisite Phase is completed to inform the Student Services offices that the block can be removed. The online request 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. Students may submit the Change of Status request by logging in to MyCTI.

Fundamental Phase

The courses in the Fundamental Phase for the MS in Computer Graphics and Animation are:
HCI 470 Digital Page Formatting I
GPH 425 Survey of Computer Graphics
GPH 438 Computer Animation Survey
GPH 448 Computer Graphics Scripting

Core Phase

The Core Knowledge Phase courses for the MS in Computer Graphics and Animation are:

Technical Directors concentration

HCI 471 Digital Page Formatting II
HCI 422 Multimedia
GPH 560 Modeling Spaces

Developers concentration

GPH 436 Fundamentals of Computer Graphics
GPH 469 Computer Graphics Development
GPH 572 Principles of Computer Animation

Advanced Phase

The Advanced Phase courses for the MS in Computer Graphics and Animation are:

Both concentrations

GPH 539 Advanced Rendering Techniques

Technical Directors concentration

GPH 565 Designing for Visualization

Developers concentration,

GPH 570 Visualization

Elective Courses

Students in this program will have 4 electives to be chosen from the following list

GPH 436 Fundamentals of Computer Graphics
GPH 469 Computer Graphics Development
GPH 536 Smooth Surface Modeling for Graphics and Animation
GPH 560 Modeling Spaces
GPH 572 Principles of Computer Animation
GPH 574 Computer Games
GPH 575 Advanced Graphics Development
GPH 576 Artificial Intelligence in Computer Games
GPH 595 Topics in Graphics
HCI 422 Multimedia
HCI 423 Internet Multimedia
HCI 440 Usability Engineering
HCI 450 Foundations of Human-Computer Interaction
HCI 460 Usability Evaluation Methods
HCI 471 Digital Page Formatting II

COMPUTER, INFORMATION AND NETWORK SECURITY

The Master of Science in Computer, Information and Network Security is intended for those students who wish to specialize in the security aspects of the Information Technology (IT) field. It is suited for students who wish to pursue work in a security related field. Students who complete the program will be prepared to

- Assess the information security risks faced by an organization;
- Understand technology and human factors related to these risks;
- Evaluate tools and resources currently available to limit risk, mitigate the effects of hostile action and recover from attack;
- Manage the development, implementation and evolution of a security infrastructure;
- Assess the impact of policy, legislation and market trends on organizational security objectives;
- Design, implement and maintain software systems designed to support security policy and goals;
- Develop and maintain a network architecture consistent with mitigating risk and preventing hostile attack; and
- Be lifelong learners in the information security environment.

Students must complete the requirements of one of the three concentrations: Computer Security, Information System Security, or Network Security.

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**
- **Foundation 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.

Grade and GPA requirements

Students must receive a grade of B- or better in each prerequisite course and a C- or better in all other courses. GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.90 or higher will graduate with distinction.

Prerequisite Phase

The following courses are required for the **Computer Security concentration**:

CSC 211 Programming in Java I
CSC 212 Programming in Java II
or CSC 224 Java for Programmers
or CSC 396 Programming in Java I and II
CSC 309 Object-Oriented Programming in C++
or CSC 261 Programming Languages I: C/C++
and CSC 262 Programming Languages II: C/C++
CSC 383 Data Structures and Algorithms in Java

CSC 373 Computer Systems I
CSC 374 Computer Systems II
CSC 390 Fundamentals of Information Assurance

The following courses are required for the **Information Systems Security concentration**:

CSC 211 Programming in Java I
CSC 212 Programming in Java II
or CSC 224 Java for Programmers
or CSC 396 Programming in Java I and II
IT 223 Data Analysis
IT 215 Analysis and Design Techniques
ECT 310 Internet Application Development
CSC 390 Fundamentals of Information Assurance

The following courses are required for the **Network Security concentration**:

CSC 211 Programming in Java I and CSC 212 Programming in Java II
or CSC 261 Programming Languages I: C/C++ and any more advanced programming course
IT 223 Data Analysis
MAT 140 Discrete Mathematics I
TDC 311 Computers in Telecommunications Systems
or CSC 373 Computer Systems I
TDC 361 Basic Communication Systems
CSC 390 Fundamentals of Information Assurance

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 Foundation Phase courses prior to completing their prerequisites. The student must submit an online Change of Status request when the Prerequisite Phase is completed to inform the Student Services offices that the block can be removed. The online request 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. Students may submit the Change of Status request by logging in to MyCTI.

Foundation Phase

The following two (2) courses are required for the **Computer Security Concentration**:

DS 420 Foundations of Distributed Systems I
SE 450 Object-Oriented Software Development

The following two (2) courses are required for the **Information Systems Security Concentration**:

IS 425 Enterprise Information
TDC 463 Computer Networks and Data Systems

The following two (2) courses are required for **Network Security Concentration**:

TDC 460 Foundations of Communications Systems
TDC 463 Computer Networks and Data Systems

The following three (3) courses are required for **all concentrations**:

IS 511 Social Issues of Computing
IS 572 Information Security Management
TDC 572 Network Security

Foundation Phase GPA Requirements

To progress to the Advanced Phase of the degree, a student must complete the Prerequisite Phase and Foundation Phases.

GPA Requirement:

A student must achieve an average grade of 3.0 or better in the five (5) courses that form the Foundation Phase.

A student who does not meet the grade requirement must retake the course with the lowest grade. If a number of such courses exist, then it is up to the student to choose which class to retake. Only the higher grade will count toward the average grade for the purpose of completing the GPA Requirement.

Students that do not meet the GPA requirements, and do not want to re-take a class are encouraged to see faculty advising guidance to discuss their options.

A maximum of four (4) courses in the Advanced Phase can be taken before a student completes the Foundation Phase and fulfill the GPA Requirement.

Advanced Phase

The MS-CINS advanced phase is composed of four (4) parts:

- CINS Concentration Area
- CINS Elective
- CTI Open Electives
- Capstone or Thesis Requirement

CINS Concentration Area

According to their concentration a student must meet the following requirements:

Computer Security Concentration:

1) Complete the following 2 courses:

CSC 440 Cryptology

SE 473 Security Architecture I

2) Complete two (2) of the following three (3) courses:

DS 421 Foundations of Distributed Systems II

SE 547 Foundations of Computer Security

SE 573 Security Architecture II

Information Systems Security Concentration:

Complete four (4) of the following six (6) courses:

SE 430 Object Oriented Modeling

IS 483 Information Services and Operations

IS 540 Global Information Technology

ECT 582 Secure Electronic Commerce

ECT 585 Legal Aspects of E-Commerce

IS 505 Business Continuity and Disaster Recovery

Network Security Concentration:

1) Complete the following 2 courses:

TDC 511 Telecommunications Practicum

TDC 563 Protocols and Techniques for Data Networks

2) Complete two (2) of the following four (4) courses:

TDC 562 Computer-Communication Network Design and Analysis
TDC 567 Telecommunication Systems Design and Management
ECT 582 Secure Electronic Commerce
IS 505 Business Continuity and Disaster Recovery

CINS Elective

Student must complete 1 additional course from any CINS concentration area. It can be from their concentration area or any others. That course can not be used to fulfill a student's CINS Concentration Area requirement.

CTI Open Electives

Student must complete two (2) CTI open electives.

Elective courses are in the range of 420-699 and must be from the school of CTI.

Capstone or Thesis Requirement

The capstone class provides an opportunity for students to demonstrate and assess the skills they have developed during the rest of the degree.

Students should either take one of:

CNS 594 Computer Information and Network Security Capstone
or CSC 698, ECT 698, IS 698, SE 698, TDC 698 Masters Thesis

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. As part of the Advanced Phase, students get a breadth of training in traditional areas of computer science by taking one course each in Foundations, Computer Systems, and Database Systems. The remainder of the Advanced Phase gives students a great deal of flexibility. A student may choose to focus in a specific area by taking many courses in one area of computer science or from one of the other degree programs in CTI. Or, they may achieve a breadth of knowledge across many areas by selecting courses from a variety of areas. 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 masters 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 masters student. In the Core Knowledge phase, a student will follow a sequence of courses to acquire an understanding of the technological and theoretical foundations for the particular degree. In the Advanced Phase of the program, the fundamental information learned previously allows a student to study advanced topics within their chosen degree. This phase adds depth to the work completed in the Core Knowledge Phase. Individual interests and needs are also addressed through a series of elective courses chosen in consultation with the student's faculty advisor.

Grade and GPA requirements

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

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.90 or higher will graduate with distinction.

Prerequisite Phase

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

CSC 211 Programming in Java I and CSC 212 Programming in Java II
or CSC 224 Java for Programmers
or CSC 396 Programming in Java I and II
CSC 309 Object-Oriented Programming in C++
or CSC 261 Programming Languages I: C/C++ and CSC 262 Programming Languages II: C/C++
CSC 373 Computer Systems I
CSC 374 Computer Systems II
CSC 383 Data Structures and Algorithms in Java

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 an online Change of Status request when the Prerequisite Phase is completed to inform the Student Services offices that the block can be removed. The online request 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. Students may submit the Change of Status request by logging in to MyCTI.

Core Knowledge Phase

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

CSC 447 Concepts of Programming Languages
CSC 491 Design and Analysis of Algorithms
SE 450 Object-Oriented Software Development Methods

Advanced Phase

One course in each of the following areas: Foundations, Computer Systems, Database Systems

Four additional courses from the areas above or Artificial Intelligence, Computer Vision, Data Analysis, Computer Graphics, Software Engineering, Security, Network Technologies, two of which must be 500-level. Courses are grouped into different areas below for your convenience. A student may concentrate in one area by taking all 4 courses from the same area, or may wish to take courses from a variety of areas.

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.

Overall, at least four 500-level courses.

There is a research option for this degree as well.

Database Systems Area

CSC 449 Database Technologies
CSC 451 Database Design
CSC 452 Database Programming
CSC 454 Database Administration and Management
CSC 549 Database System Implementation
CSC 550 Object-Oriented Databases
CSC 551 Distributed Database Systems
CSC 553 Advanced Database Concepts
CSC 589 Topics in Database
DS 575 Intelligent Information Retrieval

Foundations Area

CSC 444 Automata Theory and Formal Grammars
CSC 448 Compiler Design
CSC 503 Parallel Algorithms
CSC 504 Parallel Processing
CSC 535 Formal Semantics of Programming Languages
CSC 544 Theory of Computation
CSC 547 Advanced Topics in Program Languages
CSC 548 Advanced Compiler Design
CSC 599 Topics in Computer Science
DS 591 Distributed Algorithms
SE 580 Design of Object-Oriented Languages
SE 590 Advanced Topics in Object Oriented Technology

Computer Systems Area

CSC 545 Advanced Computer Organization
CSC 546 Operating Systems Design
DS 420 Foundations of Distributed Systems I
DS 421 Foundations of Distributed Systems II
DS 513 Client/Server Technologies
DS 520 System Design and Implementation with Distributed Object Frameworks
DS 594 Distributed Systems Project
DS 599 Topics in Distributed Systems
SE 540 Software Development for Mobile and Wireless Systems
SE 542 Software Development for Limited and Embedded Devices
SE 550 Distributed Software Development
SE 552 Concurrent Software Development
TDC 561 Network Programming

Artificial Intelligence Area

CSC 457 Expert Systems
CSC 458 Symbolic Programming
CSC 480 Foundations of Artificial Intelligence
CSC 578 Neural Networks and Machine Learning
CSC 587 Cognitive Science
CSC 594 Topics in Artificial Intelligence
DS 575 Intelligent Information Retrieval

Computer Vision Area

CSC 481 Introduction to Image Processing
CSC 498 Digital Signal Processing
CSC 538 Vision Systems
CSC 581 Applied Image Analysis
CSC 584 Computer Vision
CSC 592 Topics in Computer Vision and Pattern Recognition

Data Analysis Area

CSC 423 Data Analysis and Regression
CSC 424 Advanced Data Analysis
CSC 428 Data Analysis for Experimenters
CSC 521 Monte Carlo Simulations: Algorithms and Applications
CSC 578 Neural Networks and Machine Learning
CSC 598 Topics in Data Analysis
ECT 584 Web Data Mining for Business Intelligence
SE 468 Software Measurement/Project Estimation
SE 567 Software Reliability

Computer Graphics Area

GPH 436 Fundamentals of Computer Graphics
GPH 438 Computer Animation Survey
GPH 448 Computer Graphics Scripting
GPH 469 Computer Graphics Development
GPH 470 Survey of Computer Graphics
GPH 536 Smooth Surface Modeling for Graphics and Animation
GPH 539 Advanced Rendering Techniques
GPH 560 Modeling Spaces
GPH 570 Visualization
GPH 572 Principles of Computer Animation
GPH 574 Computer Games
GPH 575 Advanced Graphics Development
GPH 595 Topics in Graphics

Software Engineering Area

SE 427 Software Quality Management
SE 430 Object Oriented Modeling
SE 431 Formal Software Specification and Development I
SE 433 Software Testing
SE 452 Object-Oriented Enterprise Computing
SE 465 Software Engineering Principles
SE 468 Software Measurement/Project Estimation
SE 469 Software Safety
SE 470 Software Development Processes
SE 472 Personal Software Process
SE 477 Software and Systems Project Management
SE 480 Software Architecture
SE 482 Requirements Engineering
SE 529 Software Risk Management
SE 531 Formal Software Specifications and Development II
SE 533 Software Validation and Verification
SE 546 Software Architecture and Design for Desktop Applications
SE 554 Enterprise Component Architecture
SE 558 Software Methodologies
SE 560 Structured Document Interchange and Processing
SE 571 Software Maintenance

Security Area

CSC 440 Cryptology
DS 420 Foundations of Distributed Systems I
DS 421 Foundations of Distributed Systems II
ECT 582 Secure Electronic Commerce
IS 511 Social Issues of Computing
IS 572 Information Security Management
SE 473 Security Architecture I
SE 547 Foundations of Computer Security
SE 573 Security Architecture II
TDC 511 Telecommunications Practicum
TDC 562 Computer-Communication Network Design and Analysis
TDC 563 Protocols and Techniques for Data Networks
TDC 572 Network Security

Network Technologies Area

TDC 432 Computer and Information Systems Modeling
TDC 460 Foundations of Communications Systems
TDC 463 Computer Networks and Data Systems
TDC 464 Voice Communication Networks
TDC 489 Queuing Theory with Computer Application
TDC 511 Telecommunications Practicum
TDC 512 Cellular and Wireless Telecommunications
TDC 513 Client/Server Technologies
TDC 514 Computer Telephony
TDC 561 Network Programming
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
TDC 572 Network Security
TDC 573 Multimedia Networking

Masters Research Option

Students interested in a more in-depth study of a particular area can choose to work with a faculty member (not necessarily their academic advisor) on a research project. This option can be

satisfied by taking the course CSC 696 (Masters Project) at least twice, each time for 4 credits. The Masters research option will replace one elective and one of the 4 required area courses. Students who choose this option must successfully complete the core exams prior to their first enrollment in CSC 696. The research project must represent an original contribution to the area, and may include system development, empirical studies, or theoretical work. The scope and the details of the research project will be determined by the research supervisor, and must be approved by the student's academic advisor. At the end of the two quarters, the student must submit a technical report detailing the results of the research project. This report must be approved by the student's research supervisor and the faculty advisor, at which point it will be made available to the public as a CTI Departmental Technical Report.

DISTRIBUTED SYSTEMS

The 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 core phase includes software development in languages such as Java, the study of frameworks such as J2EE, .Net, and CORBA, and the use of traditional network routing and protocols. In the Advanced Phase, students study network and concurrent programming, databases, distributed algorithms, 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, Internet, and Web-based 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**
- **Foundation 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.

Grade and GPA requirements

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

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.90 or higher will graduate with distinction.

Prerequisite Phase

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

CSC 211 Programming in Java I and CSC 212 Programming in Java II

or CSC 224 Java for Programmers

or CSC 396 Programming in Java I and II

CSC 309 Object-Oriented Programming in C++

or CSC 261 Programming Languages I: C/C++ and CSC 262 Programming Languages II: C/C++

CSC 373 Computer Systems I

CSC 374 Computer Systems II

CSC 383 Data Structures and Algorithms in Java

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 an online Change of Status request when the Prerequisite Phase is completed to inform the Student Services offices that the block can be removed. The online request 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. Students may submit the Change of Status request by logging in to MyCTI.

Foundation Phase

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

DS 420 Foundations of Distributed Systems I
DS 421 Foundations of Distributed Systems II
SE 450 Object-Oriented Software Development

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 Phase. Students must complete the following five courses:

CSC 449 Database Technologies
CSC 491 Design and Analysis of Algorithms
SE 452 Object-Oriented Enterprise Computing
SE 550 Distributed Software Development
TDC 561 Network Programming

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

CSC 480 Foundations of Artificial Intelligence
CSC 503 Parallel Algorithms
CSC 549 Database System Implementation
CSC 551 Distributed Database Systems
CSC 580 Artificial Intelligence Programming
DS 520 System Design and Implementation with Distributed Object Frameworks
DS 575 Intelligent Information Retrieval
DS 591 Distributed Algorithms
DS 599 Topics in Distributed Systems
SE 533 Software Validation and Verification
SE 552 Concurrent Software Development
SE 554 Enterprise Component Architecture
SE 560 Structured Document Interchange and Processing
SE 473 Security Architecture I
SE 573 Security Architecture II
TDC 562 Computer-Communication Network Design and Analysis
TDC 568 Network Management
TDC 572 Network Security

Elective Courses

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's Research Option:

Two terms of DS 599 may be taken as a research project under faculty supervision. The two DS 599 courses replace (a) one open elective and (b) one advanced phase requirement.

E-COMMERCE TECHNOLOGY

The Master of Science in E-Commerce Technology is designed for those who want to specialize in e-business systems development and management. Modern organizations are designing and deploying Internet-based technologies for integrated e-commerce transactions, supply chain management, customer relationship management, and enterprise portals. The movement toward e-business collaboration among organizations along industry value chains will demand IT professionals to develop strong technical skills as well as a deep knowledge of IT architecture and business processes. The MS in E-Commerce Technology exposes students to a broad and ever-changing mix of technologies, programming languages and tools. Practicum, team projects, and work for real clients provide an authentic environment for learning. The new curriculum provides flexible, modularized advanced training in e-business systems as well as competencies in Internet application development, advanced Internet technologies, and wireless applications. Students may also expand their competencies in IT architecture design, project management, enterprise systems integration, or design of information security, networks, and databases.

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**
- **Foundation Phase**
- **Advanced Phase**

Upon acceptance into the master's degree program, the student will meet with a 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 Foundation 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 the chosen degree. This phase adds depth to the work completed in the Foundation Phase. Individual interests and needs are also addressed through a series of elective courses chosen in consultation with the student's faculty advisor.

Grade and GPA requirements

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

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.90 will graduate with distinction.

Prerequisite Phase

The courses in the Prerequisite Phase for the Master of E-Commerce Technology are:

CSC 211 Programming in Java I
CSC 212 Programming in Java II
or CSC 224 Java for Programmers
or CSC 396 Programming in Java I and II
TDC 361 Basic Communication Systems
ECT 310 Internet Application Development
SE 325 Principles and Practices of Software Engineering

CSC 383 Data Structures and Algorithms in Java

*CSC 224 is equivalent to both CSC 211 and CSC 212. Only students with experience in programming languages should take CSC 224.

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 Foundation Phase courses prior to completing their prerequisites. The student must submit an online Change of Status request when the Prerequisite Phase is completed to inform the Student Services offices that the block can be removed. The online request 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. Students may submit the Change of Status request by logging in to MyCTI.

Foundation Phase

CSC 449 Database Technologies

ECT 425 Technical Fundamentals of Distributed Information Systems

ECT 455 E-Commerce Web Site Engineering

SE 430 Object Oriented Modeling

Advanced Phase (8 courses; at least four 500-level courses)

Required (3 courses)(Note: Along with ECT 455 and ECT 589 or ECT 590, these five courses constitute the E-Business Systems module.)

ECT 480 Intranets and Portals

ECT 481 Internet Supply Chain Management

ECT 582 Secure Electronic Commerce

Electives (5 courses)

With numerous pre-defined competency modules, students can gain expertise in addition to competency in e-business systems. A Student can take four courses listed in one of the competencies based on their career goals and preferences. Students can fulfill these electives by taking courses in:

One pre-defined competency module or a customized module, and additional elective courses.

Capstone (1 course)

ECT 589 E-Commerce Technology Capstone, or

ECT 590 E-Business Technology Practicum

Advanced Electives

- E-Commerce Technology Modules
- Database Design I
- Database Design II
- Application Development
- Software Engineering
- Data Mining & Analytics
- Network Design
- e-Business Systems
- HCI Methods
- Internet Application Development
- Information Assurance & Security Design
- Enterprise Systems Integration
- Project Management
- Wireless/Mobile Applications
- Knowledge Management
- Advanced Internet Technologies
- IT Architecture Design

- IT Planning and Strategies
- Global Systems & Strategies
- Legal & Social Issues

Database Design I

CSC 449 Database Technologies
 CSC 451 Database Design
 CSC 452 Database Programming
 CSC 454 Database Administration and Management
 IS 549 Data Warehousing and Data Mining

Database Design II

CSC 550 Object-Oriented Databases
 CSC 551 Distributed Database Systems
 CSC 553 Advanced Database Concepts
 IS 549 Data Warehousing and Data Mining
 IS 556 Project Management

Application Development

SE 452 Object-Oriented Enterprise Computing
 SE 470 Software Development Processes
 SE 482 Requirements Engineering
 IS 556 Project Management
 HCI 440 Usability Engineering
 SE 560 Structured Document Interchange and Processing
 IS 450 Enterprise System Implementation
 ECT 455 E-Commerce Web Site Engineering
 ECT 583 Advanced Scripting Technologies

Software Engineering

SE 450 Object-Oriented Software Development
 SE 452 Object-Oriented Enterprise Computing
 SE 550 Distributed Software Development
 SE 480 Software Architecture
 IS 556 Project Management
 HCI 440 Usability Engineering

Data Mining & Analytics

ECT 584 Web Data Mining for Business Intelligence
 IS 567 Knowledge Discovery Technologies
 CSC 423 Data Analysis and Regression
 IS 574 Decision Support Systems and Intelligent Systems
 ECT 480 Intranets and Portals
 IS 456 Knowledge Management Systems

Network Design

TDC 463 Computer Networks and Data Systems
 TDC 511 Telecommunications Practicum
 TDC 564 Local Area Networks
 TDC 567 Telecommunication Systems Design and Management

e-Business Systems

ECT 455 E-Commerce Web Site Engineering
 ECT 480 Intranets and Portals
 ECT 481 Internet Supply Chain Management
 ECT 582 Secure Electronic Commerce
 ECT 586 Customer Relationship Management Technologies
 ECT 589 E-Commerce Technology Capstone
 ECT 590 E-Business Technology Practicum

HCI Methods

HCI 430 Prototyping and Implementation
HCI 440 Usability Engineering
HCI 450 Foundations of Human-Computer Interaction
HCI 460 Usability Evaluation Methods
HCI 445 Analysis and Design for Hci

Internet Application Development

ECT 455 E-Commerce Web Site Engineering
ECT 583 Advanced Scripting Technologies
HCI 440 Usability Engineering
IS 556 Project Management
SE 560 Structured Document Interchange and Processing
ECT 587 Mobile Commerce Technology
ECT 588 E-Marketplace Technology

Information Assurance & Security Design

IS 505 Business Continuity and Disaster Recovery
IS 511 Social Issues of Computing
TDC 463 Computer Networks and Data Systems
TDC 572 Network Security
ECT 582 Secure Electronic Commerce
CNS 594 Computer Information and Network Security Capstone

Enterprise Systems Integration

IS 450 Enterprise System Implementation
IS 560 Enterprise Systems
ECT 480 Intranets and Portals
ECT 481 Internet Supply Chain Management
ECT 586 Customer Relationship Management Technologies
ECT 565 Mobile Enterprise
IS 556 Project Management

Project Management

IS 556 Project Management
IS 450 Enterprise System Implementation
IS 512 Groupware and Virtual Collaboration
IS 560 Enterprise Systems
IS 578 Information Technology Consulting
IS 483 Information Services and Operations

Wireless/Mobile Applications

ECT 587 Mobile Commerce Technology
ECT 565 Mobile Enterprise
HCI 440 Usability Engineering
HCI 530 Usability Issues for Handheld Devices
SE 540 Software Development for Mobile and Wireless Systems

Knowledge Management

IS 456 Knowledge Management Systems
ECT 480 Intranets and Portals
IS 575 Intelligent Information Retrieval
CSC 480 Foundations of Artificial Intelligence
IS 574 Decision Support Systems and Intelligent Systems

Advanced Internet Technologies

ECT 587 Mobile Commerce Technology
ECT 557 Peer-To-peer Technology
ECT 588 E-Marketplace Technology
ECT 590 E-Business Technology Practicum

IT Architecture Design

ECT 565 Mobile Enterprise
ECT 556 Enterprise Architecture and Design
DS 520 System Design and Implementation with Distributed Object Frameworks
SE 450 Object-Oriented Software Development
SE 554 Enterprise Component Architecture
SE 480 Software Architecture
SE 473 Security Architecture I
CSC 551 Distributed Database Systems
ECT 590 E-Business Technology Practicum
TDC 463 Computer Networks and Data Systems
TDC 567 Telecommunication Systems Design and Management

IT Planning and Strategies

ECT 565 Mobile Enterprise
IS 511 Social Issues of Computing
ECT 556 Enterprise Architecture and Design
IS 577 Information Systems Capstone
IS 540 Global Information Technology
ECT 589 E-Commerce Technology Capstone
IS 556 Project Management

Global Systems & Strategies

IS 450 Enterprise System Implementation
IS 511 Social Issues of Computing
IS 421 Information Systems Analysis
IS 577 Information Systems Capstone
IS 540 Global Information Technology
IS 483 Information Services and Operations
ECT 589 E-Commerce Technology Capstone

Legal & Social Issues

IS 482 Legal Aspects of Information Technology
ECT 585 Legal Aspects of E-Commerce
IS 511 Social Issues of Computing
IS 450 Enterprise System Implementation
TDC 569 Telecommunication Regulation, Policy, law and Standards

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 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 Courses**
- **Capstone Course**

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

Grade and GPA requirements

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

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.90 or higher will graduate with distinction.

Prerequisite Courses

The courses in the Prerequisite Phase for the MS in Human-Computer Interaction are listed below. Students who intend to take implementation courses at the graduate level are encouraged to take CSC 212 and the graduate-level database course (CSC 449).

IT 130 The Internet and the Web
IT 223 Data Analysis
CSC 211 Programming in Java I
*CSC 212 Programming in Java II
or IT 240 Introduction to Desktop Databases
IT 236 User Interface Development
HCI 402 Foundations of Digital Design

*In place of CSC 211 and CSC 212, students may take CSC 396. CSC 224 is also a substitute for CSC 211 and 212 if students have prior programming experience.

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. The student must submit an online Change of Status request when the Prerequisite Phase is completed to inform the Student Services offices that the block can be removed. The online request 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. Students may submit the Change of Status request by logging in to MyCTI.

Fundamentals Courses

Students should complete their Prerequisite courses before beginning the Fundamental courses. However, while completing the Prerequisite courses, students may take Fundamental courses with consent of their faculty advisor. The Fundamental courses for the MS in Human-Computer Interaction are:

HCI 440 Introduction to Human-Computer Interaction
HCI 450 Foundations of Human-Computer Interaction
HCI 470 Digital Page Formatting I

Core Courses

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

HCI 430 Prototyping and Implementation
HCI 445 Analysis and Design for Hci
HCI 460 Usability Evaluation Methods
HCI 471 Digital Page Formatting II

Advanced Phase Courses

Students must complete four courses either from the HCI offering or from the courses listed below, plus one advisor-approved elective from the School of CTI. All advanced phase courses in CTI must be numbered 420 or higher.

The HCI offering includes: (but is not limited to)

HCI 422 Multimedia
HCI 511 Designing for Disabilities
HCI 530 Usability Issues for Handheld Devices
HCI 590 Topics in Human-Computer Interaction

Non-HCI Advanced phase courses open to all HCI graduate students

ART 405 Advanced Color Design
ART 462 Title Unavailable
CSC 423 Data Analysis and Regression
CSC 424 Advanced Data Analysis
CSC 428 Data Analysis for Experimenters
CSC 587 Cognitive Science
ECT 433 Survey of Web Programming Technologies
ECT 455 E-Commerce Web Site Engineering
IS 450 Enterprise System Implementation
ITS 427 Information Processing Models of Learning
ITS 560 Instructional Technology Training and User Support
PSY 402 Perceptual Processes
PSY 404 Learning and Cognitive Processes
PSY 645 Organizational Development
PSY 646 Needs Analysis
PSY 647 Organizational Consulting: Diagnostics
PSY 649 Testing: Measurement, Application, and Legal Considerations
PSY 650 Creativity and Decision Making

Advanced phase courses open to students who have taken CSC 212

CSC 449 Database Technologies
GPH 425 Survey of Computer Graphics
GPH 438 Computer Animation Survey
SE 430 Object Oriented Modeling

Capstone Course

HCI 594 Human-Computer Interaction Capstone

INFORMATION SYSTEMS

The master's degree program in Information Systems (IS) provides flexible, modularized advanced training in IS design and management. Today organizations expect IS professionals to be competent in both breadth and depth of IT solutions. Students in this program are not only exposed to the breadth of information technologies (IT) but can also attain multiple competencies as IS professionals. With numerous competencies available, a student can choose those competencies that best meet current and future career plans. Future career possibilities include systems analysts, business analysts, IS managers, project leaders, IT consultants, database designers, enterprise systems integrators, IT architects, e-business systems developers, and network designers, who can integrate people, process, and organization to provide cutting-edge IT solutions.

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

- **Prerequisite Phase**
- **Foundation Phase**
- **Advanced Phase**
- **Capstone Course**

Upon acceptance into the master's degree program, the student will meet with a 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.

After the Prerequisite Phase, the student will complete 13 graduate level courses to meet degree requirements. In the Foundation 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 with eight courses. This phase adds depth to the work completed in the Foundation Phase. Individual interests and needs are also addressed through a series of elective courses chosen in consultation with the student's faculty advisor. The student finishes the MS program with IS 577, the capstone course

Grade and GPA requirements

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

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.90 or higher will graduate with distinction.

Prerequisite Phase

CSC 211 Programming in Java I
CSC 212 Programming in Java II
or CSC 224 Java for Programmers
or CSC 396 Programming in Java I and II
IT 223 Data Analysis
IT 215 Analysis and Design Techniques
TDC 361 Basic Communication Systems
ECT 310 Internet Application Development

CSC 224 is equivalent to both CSC 211 and CSC 212. Only students with experience in programming languages should take CSC 224.

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 Foundation Knowledge Phase courses prior to completing their prerequisites. The student must submit an online Change of Status request when the Prerequisite Phase is completed to inform the Student Services offices that the block can be removed. The online request 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. Students may submit the Change of Status request by logging in to MyCTI.

Foundation Phase

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

IS 425 Enterprise Information
CSC 451 Database Design
SE 430 Object Oriented Modeling
ECT 425 Technical Fundamentals of Distributed Information Systems

Advanced Phase

Advanced Phase (8 elective courses, at least three are 500-level courses)

The advanced phase is designed to meet a student's career goals in Information Systems. With numerous predefined competency modules, a student can gain expertise in more than one area. There are two choices open to a student:

The student may attain two or more competencies, by taking at least four courses listed under each competency module. Because some courses, such as IS 556 (project management), are shared by several modules, it is possible to attain more than two competencies. A student should pick competencies based on their career goals and preferences. For example, a student can pick Application Development and Project Management for a career as project manager or a student can pick E-Business Systems and Enterprise Systems Integration for a career as a web enterprise systems integrator.

If a competency does not exist that meets a student's career plans, a student can also design a personal breadth competency consisting of a maximum of 8 courses with advisor approval.

Capstone Course (required)

IS 577 Information Systems Capstone

Information System Modules

- E-Commerce Technology Modules
- Database Design I
- Database Design II
- Application Development
- Software Engineering
- Data Mining & Analytics
- Network Design
- e-Business Systems
- HCI Methods
- Internet Application Development
- Information Assurance & Security Design
- Enterprise Systems Integration
- Project Management
- Wireless/Mobile Applications
- Knowledge Management
- Advanced Internet Technologies

- IT Architecture Design
- IT Planning and Strategies
- Global Systems & Strategies
- Legal & Social Issues

Database Design I

CSC 449 Database Technologies
 CSC 451 Database Design
 CSC 452 Database Programming
 CSC 454 Database Administration and Management
 IS 549 Data Warehousing and Data Mining

Database Design II

CSC 550 Object-Oriented Databases
 CSC 551 Distributed Database Systems
 CSC 553 Advanced Database Concepts
 IS 549 Data Warehousing and Data Mining
 IS 556 Project Management

Application Development

SE 452 Object-Oriented Enterprise Computing
 SE 470 Software Development Processes
 SE 482 Requirements Engineering
 IS 556 Project Management
 HCI 440 Usability Engineering
 SE 560 Structured Document Interchange and Processing
 IS 450 Enterprise System Implementation
 ECT 455 E-Commerce Web Site Engineering
 ECT 583 Advanced Scripting Technologies

Software Engineering

SE 450 Object-Oriented Software Development
 SE 452 Object-Oriented Enterprise Computing
 SE 550 Distributed Software Development
 SE 480 Software Architecture
 IS 556 Project Management
 HCI 440 Usability Engineering

Data Mining & Analytics

ECT 584 Web Data Mining for Business Intelligence
 IS 567 Knowledge Discovery Technologies
 CSC 423 Data Analysis and Regression
 IS 574 Decision Support Systems and Intelligent Systems
 ECT 480 Intranets and Portals
 IS 456 Knowledge Management Systems

Network Design

TDC 463 Computer Networks and Data Systems
 TDC 511 Telecommunications Practicum
 TDC 564 Local Area Networks
 TDC 567 Telecommunication Systems Design and Management

e-Business Systems

ECT 455 E-Commerce Web Site Engineering
 ECT 480 Intranets and Portals
 ECT 481 Internet Supply Chain Management
 ECT 582 Secure Electronic Commerce
 ECT 586 Customer Relationship Management Technologies
 ECT 589 E-Commerce Technology Capstone
 ECT 590 E-Business Technology Practicum

HCI Methods

HCI 430 Prototyping and Implementation
HCI 440 Usability Engineering
HCI 450 Foundations of Human-Computer Interaction
HCI 460 Usability Evaluation Methods
HCI 445 Analysis and Design for Hci

Internet Application Development

ECT 455 E-Commerce Web Site Engineering
ECT 583 Advanced Scripting Technologies
HCI 440 Usability Engineering
IS 556 Project Management
SE 560 Structured Document Interchange and Processing
ECT 587 Mobile Commerce Technology
ECT 588 E-Marketplace Technology

Information Assurance & Security Design

IS 505 Business Continuity and Disaster Recovery
IS 511 Social Issues of Computing
TDC 463 Computer Networks and Data Systems
TDC 572 Network Security
ECT 582 Secure Electronic Commerce
CNS 594 Computer Information and Network Security Capstone

Enterprise Systems Integration

IS 450 Enterprise System Implementation
IS 560 Enterprise Systems
ECT 480 Intranets and Portals
ECT 481 Internet Supply Chain Management
ECT 586 Customer Relationship Management Technologies
ECT 565 Mobile Enterprise
IS 556 Project Management

Project Management

IS 556 Project Management
IS 450 Enterprise System Implementation
IS 512 Groupware and Virtual Collaboration
IS 560 Enterprise Systems
IS 578 Information Technology Consulting
IS 483 Information Services and Operations

Wireless/Mobile Applications

ECT 587 Mobile Commerce Technology
ECT 565 Mobile Enterprise
HCI 440 Usability Engineering
HCI 530 Usability Issues for Handheld Devices
SE 540 Software Development for Mobile and Wireless Systems

Knowledge Management

IS 456 Knowledge Management Systems
ECT 480 Intranets and Portals
IS 575 Intelligent Information Retrieval
CSC 480 Foundations of Artificial Intelligence
IS 574 Decision Support Systems and Intelligent Systems

Advanced Internet Technologies

ECT 587 Mobile Commerce Technology
ECT 557 Peer-To-peer Technology
ECT 588 E-Marketplace Technology
ECT 590 E-Business Technology Practicum

IT Architecture Design

ECT 565 Mobile Enterprise
ECT 556 Enterprise Architecture and Design
DS 520 System Design and Implementation with Distributed Object Frameworks
SE 450 Object-Oriented Software Development
SE 554 Enterprise Component Architecture
SE 480 Software Architecture
SE 473 Security Architecture I
CSC 551 Distributed Database Systems
ECT 590 E-Business Technology Practicum
TDC 463 Computer Networks and Data Systems
TDC 567 Telecommunication Systems Design and Management

IT Planning and Strategies

ECT 565 Mobile Enterprise
IS 511 Social Issues of Computing
ECT 556 Enterprise Architecture and Design
IS 577 Information Systems Capstone
IS 540 Global Information Technology
ECT 589 E-Commerce Technology Capstone
IS 556 Project Management

Global Systems & Strategies

IS 450 Enterprise System Implementation
IS 511 Social Issues of Computing
IS 421 Information Systems Analysis
IS 577 Information Systems Capstone
IS 540 Global Information Technology
IS 483 Information Services and Operations
ECT 589 E-Commerce Technology Capstone

Legal & Social Issues

IS 482 Legal Aspects of Information Technology
ECT 585 Legal Aspects of E-Commerce
IS 511 Social Issues of Computing
IS 450 Enterprise System Implementation
TDC 569 Telecommunication Regulation, Policy, law and Standards

INSTRUCTIONAL TECHNOLOGY SYSTEMS

This MS in Instructional Technology Systems program is intended for graduate students who plan to work with Instructional Technology Systems in two possible capacities:

Students in the Software Design in Instructional Technology Track emerge as accomplished software engineers and programmers. They will be prepared for jobs in software design and construction at Universities and at coding shops that specialize in educational software.

Students in the Systems Integration in Instructional Technology Track emerge as accomplished systems planners, systems analysts, and systems managers. They will be prepared for jobs in instructional software systems management, or as business/systems analysts at coding shops that specialize in educational software.

The MS in Instructional Technology Systems will equip the student with the core theories and skills to advance to be the CIO or CTO of an instruction delivery organization. A primary focus of the degree is to develop practitioners at corporate training and development organizations. The degree is split into two tracks, matching the two capacities listed above.

This program is guided by several curriculum principles:

- Reflecting the eclectic and developing nature of current Internet and instructional technology design, this program does not presuppose any dominant technologies or programming languages. Rather, students will be exposed to a broad mix of technologies, programming languages and tools.
- The program is designed to adapt to rapid changes in both technology and industry norms.
- The program is designed around industry needs and based upon a long-term partnership with instructional technology leaders.
- The program is designed to provide maximum opportunities for practicum and team projects.

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**
- **Advanced Phase Courses**
- **Elective Courses**
- **Capstone Course**

Grade and GPA requirements

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

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.90 will graduate with distinction.

Prerequisite Courses

The courses in the Prerequisite Phase for the MS in Instructional Technology Systems:

Both Tracks

CSC 211 Programming in Java I
or CSC 224 Java for Programmers
or CSC 396 Programming in Java I and II
IT 223 Data Analysis

Software Design in Instructional Technology Track

CSC 212 Programming in Java II
CSC 373 Computer Systems I
CSC 374 Computer Systems II
CSC 383 Data Structures and Algorithms in Java

Systems Integration in Instructional Technology Track

IT 240 Introduction to Desktop Databases
CSC 390 Fundamentals of Information Assurance
IT 215 Analysis and Design Techniques
TDC 361 Basic Communication Systems

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 the graduate phase of the degree prior to completing their prerequisites. The student must submit an online Change of Status request when the Prerequisite Phase is completed to inform the Student Services offices that the block can be removed. The online request 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. Students may submit the Change of Status request by logging in to MyCTI.

Fundamentals Courses

Students should complete their Prerequisite courses before beginning the Fundamental courses. However, while completing the Prerequisite courses, students may take Fundamental courses with consent of their faculty advisor. The Fundamental courses for the MS in Instructional Technology Systems are

Both Tracks

HCI 440 Usability Engineering
HCI 460 Usability Evaluation Methods
ITS 427 Information Processing Models of Learning
ITS 431 Instructional Delivery and Course Management Systems
ITS 560 Instructional Technology Training and User Support

Software Design Track

DS 420 Foundations of Distributed Systems I
SE 450 Object-Oriented Software Development

Systems Integration in Instructional Technology Track

ITS 440 Distance Learning Technologies
HCI 445 Analysis and Design for HCI

Advanced Phase**Software Design in Instructional Technology Track**

Options: Pick Three from the list below:

CSC 449 Database Technologies
CSC 457 Expert Systems
CSC 458 Symbolic Programming
CSC 480 Foundations of Artificial Intelligence
CSC 578 Neural Networks and Machine Learning
CSC 587 Cognitive Science
DS 421 Foundations of Distributed Systems II
DS 520 System Design and Implementation with Distributed Object Frameworks
DS 575 Intelligent Information Retrieval
ECT 480 Intranets and Portals
HCI 422 Multimedia
HCI 423 Internet Multimedia
ITS 440 Distance Learning Technologies
ITS 584 Artificial Intelligence in Learning Environments
SE 452 Object-Oriented Enterprise Computing
SE 550 Distributed Software Development
TDC 460 Foundations of Communications Systems

Systems Integration in Instructional Technology Track

Options: Pick Three from the list below:

CSC 423 Data Analysis and Regression
CSC 424 Advanced Data Analysis
CSC 428 Data Analysis for Experimenters
ECT 425 Technical Fundamentals of Distributed Information Systems
ECT 433 Survey of Web Programming Technologies
ECT 480 Intranets and Portals
HCI 422 Multimedia
HCI 423 Internet Multimedia
HCI 430 Prototyping and Implementation
HCI 450 Foundations of Human-Computer Interaction
IS 450 Enterprise System Implementation
IS 511 Social Issues of Computing
IS 512 Groupware and Virtual Collaboration
IS 572 Information Security Management

Elective Courses**Both Tracks**

Two open electives from CTI courses numbered 420-599

Capstone Course

ITS 589 Its Capstone Projects Course

SOFTWARE ENGINEERING

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

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

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.

There is also a **Software Architecture Concentration**.

The Software Engineering program has two phases:

- **Prerequisite Phase**
- **Graduate Phase**

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

Grade and GPA requirements

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

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

Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree.

Students will not be approved for graduation with less than a 2.50 GPA.
Students with a GPA of 3.9 or higher and a grade of A in SE681, SE696 or SE698 will graduate with distinction.

Prerequisite Phase

CSC 211 Programming in Java I
CSC 212 Programming in Java II
or CSC 224 Java for Programmers
or CSC 396 Programming in Java I and II
CSC 309 Object-Oriented Programming in C++
or CSC 261 Programming Languages I: C/C++
and CSC 262 Programming Languages II: C/C++
CSC 373 Computer Systems I
CSC 374 Computer Systems II
CSC 383 Data Structures and Algorithms in Java

Graduate Phase

Students may register for graduate courses only after meeting all Prerequisite Phase requirements. The graduate phase consists of the following components:

- **Foundation Phase**
- **Advanced Phase**
- **Elective Phase**
- **Software Engineering Studio or Capstone**
- **One of the following options**
 - **Professional Option**
 - **Research Option**

Foundation Phase – All Concentrations

SE 425 Principles and Practices of Software Engineering
SE 430 Object Oriented Modeling
SE 450 Object-Oriented Software Development

Advanced Phase

Software Development Concentration

Required
SE 431 Formal Software Specification and Development I

Two of the following:

SE 473 Security Architecture I
SE 480 Software Architecture
SE 550 Distributed Software Development
SE 552 Concurrent Software Development

Project Management Concentration

Required
SE 477 Software and Systems Project Management

Two of the following:

SE 468 Software Measurement/Project Estimation
SE 470 Software Development Processes
SE 482 Requirements Engineering
SE 529 Software Risk Management

Software Architecture Concentration

Required:
ECT556 Enterprise Architecture and Design
HCI 440 Usability engineering
SE 480 Software architecture
SE 482 Requirements Engineering
SE 477 Software and Systems Project Management

One of:
IS 482 Legal aspects of IT
IS 572 Information Security Management
IS 560 Enterprise Systems
SE 468 Software Measurement/Project Estimation
SE 470 Software Development Processes
SE 529 Software Risk Management

Elective Phase

Software Development and Project Management

Two SE courses or CSC 447 or CSC 491

One CTI elective. See elective course restrictions below.

At least one of the electives must be 500 level.

Software Architecture Concentration

Electives: (3)

Elective courses are in the range of 420-699, not including SE 465 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 students 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.

- a. Two SE courses or courses listed in the Advanced Phase of any concentration.
- b. One CTI elective.
- c. At least one of the electives must be 500 level.

Capstone -- Software Architecture Concentration

SE 491 Software Engineering Studio
or ECT 589 E-Commerce Technology Capstone

Software Engineering Studio

Students in the **Software Development and Project Management concentrations** are required to complete the following:

These two courses must be taken as a sequence in consecutive quarters. Students will be working on a large, real project in a team. The project will be carried out from conceptualization to completion using the current technologies.

SE 491 Software Engineering Studio
SE 591 Software Engineering Studio II

Students must choose to either pursue the Software Development Professional option or the Research option.

Software Development Professional Option

Students in the **Software Development Concentration:**

SE 477 Software and Systems Project Management

Students in the **Project Management Concentrations:**

one course listed in the Advanced Phase of either concentration or any SE course above 500.

All students taking the Software Engineering Professional option must complete the following course:

SE 681 Software Engineering Professional Practices

Research Option

Students taking the research option must take the following course:

SE 690 Research Seminar

Student must also complete one of the following

SE 696 Master's Project

SE 698 Master's Thesis

SE 698 Masters Thesis is a two-credit hour course. Students must register for this course a minimum of two times and must continue to enroll in the course in every quarter after the first quarter until the thesis is completed to the satisfaction of their advisor. A maximum of four credit hours will apply for degree credit.

The Master's project or thesis must represent an original contribution to the area, and may include system development, empirical studies, or theoretical work. The scope and the details of the research project will be determined by the research supervisor, and must be approved by the student's academic advisor.

Elective Course Restrictions

Elective courses are in the range of 420-699, not including SE 465 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 students 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.

TELECOMMUNICATIONS

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.

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**
- **Foundation 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 Foundation 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 Foundation Phase. Individual interests and needs are also addressed through a series of elective courses chosen in consultation with the student's faculty advisor.

Grade and GPA requirements

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

GPA: Students must maintain a graduate level GPA of 2.50 or higher while pursuing their degree. Students will not be approved for graduation with less than a 2.50 GPA. Students with a GPA of 3.90 will graduate with distinction.

Prerequisite Phase

CSC 211 Programming in Java I
or CSC 261 Programming Languages I: C/C++
or any more advanced programming course
IT 223 Data Analysis
MAT 140 Discrete Mathematics I
TDC 311 Computers in Telecommunications Systems
or CSC 374 Computer Systems II
TDC 361 Basic Communication Systems

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 Foundation Phase courses prior to completing their prerequisites. The student must submit an online Change of Status request when the Prerequisite Phase is completed to inform the Student Services offices that the block can be removed. The online request 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. Students may submit the Change of Status request by logging in to MyCTI.

Foundation Phase

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

TDC 460 Fundamentals of Communication Systems
TDC 463 Computer Networks
TDC 464 Voice Communication Networks

By taking these courses and receiving a grade of a B- or better in each, the student will have completed the requirements of the Foundation Phase. If a student receives a grade below B- but better than or equal to C- for a Foundation Phase course, the student is given an option to take a course-specific core competency exam to pass the failed course. If the student fails the exam, the student must retake the failed course. The student can take an exam only once for each failed course. There is no other core examination in the Foundation Phase.

Advanced Phase

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.

TDC 511 Telecommunications Systems
TDC 567 Telecommunications System Design and Management

Five TDC courses from the range TDC 430 to TDC 599, where at least *three are numbered above 500*.

Students must also complete three open electives.

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.

JURIS DOCTORATE AND MASTER OF ARTS

The general objective of the joint JD/MA degree program at DePaul University College of Law Center for Intellectual Property Law & Information Technology (CIPLIT®) and its School of Computer Science, Telecommunications and Information Systems (CTI) is to offer law students the opportunity to acquire technology knowledge that will support them in their work in information technology law, intellectual property law, or patent law. This joint degree accommodates JD students without a technical or scientific background who are interested in intellectual property by offering a depth of knowledge and ability to communicate in technical terms. These tools are invaluable, as future intellectual property lawyers will require at a minimum a general understanding of computer and information systems, given the prominence of cyber- and telecommunications issues in today's legal practice. The JD/MA also accommodates JD students with technical or scientific backgrounds who may be interested in a broad-based exposure to computer or information systems. Where the JD/MS degree offers students an in-depth approach to specific computer science or information systems topics, the JD/MA presents a broader view that will prepare graduates of the joint degree program to interact successfully with clients and experts in computer-related fields.

Characteristics of the program include:

- This joint degree is designed to provide intensive technological training to students with non-technical backgrounds who wish to pursue legal careers focused on high technology.
- Some students may wish to use the JD/MA program as a means to fulfill the technical education requirements for the patent bar exam. Such students will need to consult closely with faculty advisors in both Schools and to contact the USPTO for specific eligibility requirements.
- It is expected that most students who pursue this joint degree will also obtain a Certificate in Intellectual Property: General, Intellectual Property: Patent or Information Technology from the law school.
- This program simultaneously offers a variety of curriculum options encompassing key technological topics along with legal courses which prepare the student for transactional and/or litigation work.

In this program, students will acquire:

- An in-depth understanding of the legal issues that confront present and future technologies.
- An understanding of legal principles and application of those principles to a growing number of legal issues facing technology
- A broad exposure to current IT theory and practices including telecommunication and data communication fundamentals, database, computer and network security, B2C e-commerce technologies, object-oriented concepts, and client server architecture.

Course Requirement Reductions in the Joint Degree Program:

- Joint degree students may substitute up to 8 law semester hours in place of up to 3 CTI master's degree courses, reducing their CTI course requirements to 10 courses plus any necessary prerequisite coursework. Courses to be substituted must be selected from the elective and required courses for the College of Law certificates in Intellectual Property: General, Intellectual Property: Patent and Information Technology. Please see the certificate pages on the College of Law website for lists of qualifying courses.
- Joint degree students may substitute up to 15 CTI credit hours in place of up to 10 of the 86 required law semester hours, reducing their law course requirements to 76 semester hours. Only CTI courses taken after enrollment in the College of Law may be substituted for law courses.
- Joint degree students may not substitute CTI credit hours for required courses in the College of Law, such as the Professional Responsibility and Senior Seminar courses

- Joint degree students must graduate from both schools on the same date, in the same semester/quarter, and in the same year. Double counting of credit hours occurs only after the student concurrently completes both degree programs. Students should consult with the joint degree advisors regarding any questions about coordinating the completion of the two degrees.

Admission Procedures and Requirements

Admission to this joint program requires: (1) completion with a 3.0 grade point average or better of the first-year required courses in the JD program at the DePaul University College of Law (part-time students must have completed three semesters) and (2) acceptance to CTI. Students should indicate their interest in the joint degree program when applying to CTI.

Application to the joint degree program should be made to Assistant Dean Diana White at the College of Law after the above requirements have been met. Applicants should submit a letter indicating their intent to apply for the joint degree program along with a copy of their first year (or first three semesters for part-time students) law grades demonstrating compliance with the 3.0 grade point average requirement. Students are encouraged to make an appointment with Dean White to discuss their joint degree applications and plans for pursuing the joint degree.

Application to CTI may be made at any time, but law students will ordinarily find it most advantageous to apply to CTI after receiving first-year law grades (ordinarily in early July following the first year.) Students accepted into the joint JD/MA Program must meet the CTI prerequisite phase course requirements for the MA degree, either through their undergraduate coursework or by adding a prerequisite phase to their joint degree program. Students who need to take prerequisite courses during their pursuit of the joint degree may require more than four years from admission to Law School to complete the Joint Degree. It is highly recommended that law students interested in the joint degree program contact Prof. Danny Mittleman or Prof. Curt White at CTI to discuss their individual circumstances before applying to CTI.

Transfer students or students who have enrolled in CTI before applying to the College of Law should consult with the joint degree program advisors to determine how their special circumstances may affect their qualifications for the joint degree.

Further information about admission requirements and procedures may be found in the general description of Admission Requirements for Joint Degrees found on the College of Law website under Academic Programs.

Financial Considerations:

- Joint degree students will pay on a per-credit-hour basis in both the College of Law and CTI
- Because the joint degree program permits double-counting of coursework, the total cost for the two degrees will be significantly lower under the joint degree program
- Admission to the joint degree program will ordinarily not affect College of Law scholarship awards. However, students should consult with Dean White about their specific scholarships
- Financial aid recipients must consult with Clare Timm at the financial aid office to obtain a revised (often increased) financial aid award based on their participation in the joint degree program

Sample Law School/CTI four-year course plan

The student must complete the regular first year JD program before being admitted to the Joint Degree. The second and third years might consist of three law courses in Fall Semester and two law courses in Spring Semester as well as one CTI course Fall Quarter, two CTI courses Winter Quarter, and two CTI courses Spring Quarter. The fourth year might consist of three law courses Fall Semester, one CTI course Fall Quarter, three CTI courses Winter Quarter, and three CTI courses Spring Quarter. This schedule allows for completion of the JD as well as completion of 14 CTI courses (the MS program plus four prerequisite courses). It is possible that, because of prerequisite coursework, the program may take some students more than four years.

Since each student will require a different number of CTI prerequisites and each student will select courses based on semester/quarter availability, any particular curriculum might be

different from the sample curriculum shown. All joint degree students will be encouraged to select courses with the assistance of Joint Degree program advisors at both the Law School and CTI.

Prerequisite Phase

The Prerequisite Phase is intended to insure that all students enter CTI coursework with adequate preparation for successful work. Students may receive waivers for the Prerequisite Phase based on prior experience, previous coursework, or performance on a Graduate Assessment Examination (GAE). The following coursework constitutes the Prerequisite Phase:

CSC 211 Programming in Java I
CSC 212 Programming in Java II
IT 263 Applied Networks and Security

Graduate Phase

The following coursework is required in the Graduate Phase:
ECT 425 Technical Fundamentals of Distributed Information Systems

CSC 449 Database Technologies
ECT 433 Survey of Web Programming Technologies
ECT 455 E-Commerce Web Site Engineering
IS 425 Enterprise Information
IS 511 Social Issues of Computing
TDC 572 Network Security
or ECT 582 Secure Electronic Commerce

Two CTI elective courses [numbered 420-599] for which the student has completed adequate prerequisites.

Culminating Thesis

The Culminating Thesis is an independent research article that demonstrates a student's ability to integrate both technical expertise and legal knowledge. Normally, it is undertaken during the student's final year in the Joint Degree program.

In this work, the student is guided and assessed by a Committee of three faculty, at least one of whom is fulltime at CTI and at least one of whom is fulltime at the College of Law. It is the responsibility of the student to find an advisor (Committee Chair) and assemble this committee.

The Masters Thesis will use the course number IT 698. It may be taken for two or four credits per quarter. 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 thesis to the satisfaction of their committee. They earn two hours of credit for each such registration but only four hours of credit will apply for degree credit.

Electives

12 additional quarter hours fulfilled by courses from the IP Certificate courses. These courses will also be counted toward the JD degree.

Joint Degree Program Advising and For Further Information

Students are encouraged to consult with the following advisors regarding their participation in the joint degree program:

- Assistant Dean Diana White - College of Law - dwhite@depaul.edu - For questions regarding administrative aspects of the joint degree and College of Law programs
- Professor Katherine Strandburg - College of Law - kstrandb@depaul.edu - For questions regarding substantive aspects of the College of Law IP and IT programs
- Professor Danny Mittleman – CTI - danny@cs.depaul.edu - For questions regarding substantive aspects of the CTI program
- Professor Curt White – CTI - cwhite@cs.depaul.edu - For questions regarding substantive aspects of the CTI program

JURIS DOCTORATE AND MASTER OF SCIENCE

The primary goal of the joint degree JD/MS program at DePaul University College of Law Center for Intellectual Property Law & Information Technology (CIPLIT®) and its School of Computer Science, Telecommunications and Information Systems (CTI) is to educate students to take advantage of the opportunities presented by the legal needs of industry in this high technology age. A critical need exists for patent attorneys in the high-tech field who have a substantive understanding of IT as well as for attorneys, who need not be members of the patent bar, to provide client counseling or litigation services in the information technology field. Graduates of the joint degree program will be qualified for careers in intellectual property boutique law firms, in general practice firms with clients in the high technology field, as in-house counsel in the high technology industry, and in government agencies dealing with high technology regulation.

Many of the students completing the joint JD/MS degree will choose to join the Patent Bar. The technical education provided by the MS part of the program will help to qualify them for the patent bar exam. However, in today's society, members of the Patent Bar are not the only attorneys who need technological expertise for successful legal practice. Many patent litigators are not members of the patent bar, yet must become intimately familiar with the technological bases for their clients' litigation positions. Trademark attorneys face infringement and prosecution issues related to domain names and Internet websites. Copyright attorneys are frequently exposed to issues of protection for computer software and Internet website content. Even lawyers who do not specialize in intellectual property law frequently face computer-related issues, as such questions arise more and more frequently in "bread-and-butter" disputes between companies immersed in high technology.

The JD/MS program is primarily aimed at students with undergraduate scientific or technical degrees or with other substantial technological or scientific background who wish to deepen their technical expertise while also obtaining a law degree.

Characteristics of the program include:

- It is designed to provide a curriculum for students with significant undergraduate technological background who wish to pursue advanced studies in Computer Science, Telecommunications, and Information Systems jointly with their legal studies.
- It offers a variety of curriculum options encompassing key technological topics along with legal courses which prepare the student for transactional and/or litigation work.
- It is expected that most students who pursue this joint degree will also obtain a Certificate in Intellectual Property: General, Intellectual Property: Patent or Information Technology from the law school.
- It is expected that most students who pursue the JD/MS degree will already be qualified to sit for the patent bar exam. Students who need to "make up" some patent bar exam requirements may be able to pursue that goal as part of this program

In this program, students will acquire:

- An in-depth understanding of the legal issues that confront present and future technologies.
- An understanding of legal principles and application of those principles to a growing number of legal issues facing technology
- Core knowledge in a particular technology discipline
- In-depth fluency with state-of-the-art technologies and IT principles.

Course Requirement Reductions in the Joint Degree Program:

- Joint degree students may substitute up to 8 law semester hours in place of up to 3 CTI master's degree courses, reducing their CTI course requirements to 10 courses plus any necessary prerequisite coursework. Courses to be substituted must be selected from the

elective and required courses for the College of Law certificates in Intellectual Property: General, Intellectual Property: Patent and Information Technology. Please see the certificate pages on the College of Law website for lists of qualifying courses.

- Joint degree students may substitute up to 15 CTI credit hours in place of up to 10 of the 86 required law semester hours, reducing their law course requirements to 76 semester hours. Only CTI courses taken after enrollment in the College of Law may be substituted for law courses.
- Joint degree students may not substitute CTI credit hours for required courses in the College of Law, such as the Professional Responsibility and Senior Seminar courses
- Joint degree students must graduate from both schools on the same date, in the same semester/quarter, and in the same year. Double counting of credit hours occurs only after the student concurrently completes both degree programs. Students should consult with the joint degree advisors regarding any questions about coordinating the completion of the two degrees.

Admission Procedures and Requirements

Admission to this joint program requires: (1) completion with a 3.0 grade point average or better of the first-year required courses in the JD program at the DePaul University College of Law (part-time students must have completed three semesters) and (2) acceptance to CTI. Students should indicate their interest in the joint degree program when applying to CTI.

Application to the joint degree program should be made to Assistant Dean Diana White at the College of Law after the above requirements have been met. Applicants should submit a letter indicating their intent to apply for the joint degree program along with a copy of their first year (or first three semesters for part-time students) law grades demonstrating compliance with the 3.0 grade point average requirement. Students are encouraged to make an appointment with Dean White to discuss their joint degree applications and plans for pursuing the joint degree.

Application to CTI may be made at any time, but law students will ordinarily find it most advantageous to apply to CTI after receiving first-year law grades (ordinarily in early July following the first year.) Students must declare a specific MS degree upon application to CTI and meet the CTI prerequisite phase course requirements for that degree, either through their undergraduate coursework or by adding a prerequisite phase to their joint degree program. Students who need to take prerequisite courses during their pursuit of the joint degree may require more than four years from admission to law school for completion of the joint degree. It is highly recommended that law students interested in the joint degree program contact Prof. Danny Mittleman or Prof. Curt White at CTI to discuss their individual circumstances before applying to CTI.

Transfer students or students who have enrolled in CTI before applying to the College of Law should consult with the joint degree program advisors to determine how their special circumstances may affect their qualifications for the joint degree.

Further information about admission requirements and procedures may be found in the general description of Admission Requirements for Joint Degrees found on the College of Law website under Academic Programs.

Financial Considerations:

- Joint degree students will pay on a per-credit-hour basis in both the College of Law and CTI
- Because the joint degree program permits double-counting of coursework, the total cost for the two degrees will be significantly lower under the joint degree program
- Admission to the joint degree program will ordinarily not affect College of Law scholarship awards. However, students should consult with Dean White about their specific scholarships
- Financial aid recipients must consult with Clare Timm at the financial aid office to obtain a revised (often increased) financial aid award based on their participation in the joint degree program

Sample Law School/CTI four-year course plan

The student must complete the regular first year JD program before being admitted to the Joint Degree. The second and third years might consist of three law courses in Fall Semester and two law courses in Spring Semester as well as one CTI course Fall Quarter, two CTI courses Winter Quarter, and two CTI courses Spring Quarter. The fourth year might consist of three law courses Fall Semester, one CTI course Fall Quarter, three CTI courses Winter Quarter, and three CTI courses Spring Quarter. This schedule allows for completion of the JD as well as completion of 14 CTI courses (the MS program plus four prerequisite courses). It is possible that, because of prerequisite coursework, the program may take some students more than four years.

Since each student will require a different number of CTI prerequisites and each student will select courses based on semester/quarter availability, any particular curriculum might be different from the sample curriculum shown. All joint degree students will be encouraged to select courses with the assistance of Joint Degree program advisors at both the Law School and CTI.

CTI Requirements for an MS Degree

For the CTI portion of the joint degree, students may major in:

- Computer Information and Network Security
- Computer Science
- Distributed Systems
- E-Commerce Technology
- Information Systems
- Telecommunications

Each program listed above follows the requirements as listed on its page on the CTI website. These requirements are divided into the Prerequisite, Core and Advanced Phases. Upon completion of those requirements, each student will move to the Elective Phase as described below.

Electives

12 additional quarter hours fulfilled by courses from the IP Certificate courses. These courses will also be counted toward the JD degree.

Joint Degree Program Advising and For Further Information

- Students are encouraged to consult with the following advisors regarding their participation in the joint degree program:
- Assistant Dean Diana White - College of Law - dwhite@depaul.edu - For questions regarding administrative aspects of the joint degree and College of Law programs
- Professor Katherine Strandburg - College of Law - kstrandb@depaul.edu - For questions regarding substantive aspects of the College of Law IP and IT programs
- Professor Danny Mittleman - CTI - danny@cs.depaul.edu - For questions regarding substantive aspects of the CTI program
- Professor Curt White - CTI - cwhite@cs.depaul.edu - For questions regarding substantive aspects of the CTI program

ADVANCED SOFTWARE DEVELOPMENT PROFESSIONAL

After completing a Master's Degree, or gaining software engineering certification, a student may decide to continue their education as a software development professional. They might come back to gain new technical skills, take advanced classes which did not fit into their degree plan, or to help with professional recertification. The IEEE Computer Society Certified Software Development Professional program requires continual recertification, which may include College and University Courses. As part of DePaul University's commitment to life-long-learning, CTI is pleased to offer students with a Master's degree or IEEE professional certification an opportunity to enroll for advanced classes.

The program is an open-ended series of courses, which does not lead to a degree. To qualify for the Advanced Software Development Professional program, a student must either:

have a Master's Degree in Computer Science, Software Engineering, or another technical, scientific or engineering field, or be certified by the IEEE Computer Society Certified Software Development (CDSP®) program.

Upon acceptance into the program, the student will meet with their faculty advisor to discuss which classes they would like to take.

After meeting with their faculty advisor, the student will have Non-Degree-Seeking status, and will be able to take any CTI class, as long as they satisfy the prerequisites for that class. If they do not have a Master's degree from DePaul University, they should discuss with their faculty advisor which classes they may have to take to satisfy these prerequisite requirements.

Courses taken as part of the Advanced Software Development Professional program may be used towards recertification for the IEEE Computer Society Certified Software Development Professional program. To be recertified, a candidate must first gain CDSP certification, and must then earn 30 Professional Development Units, 15 of which may come from College and University courses. Since each CTI course is worth 5.2 PDUs, three CTI courses will earn those 15 PDUs. CDSP recertification is required every three years, and so one CTI course per year will count for half of a candidate's recertification requirements.

A student in the Advanced Software Development Professional program who later is accepted to a degree program at DePaul University may count up to three courses taken in this program towards the degree.

Students are free to take any CTI classes they satisfy the prerequisite requirements for. The following classes may be of particular interest to software professionals:

- SE 480 Software Architecture
- SE 469 Software Safety
- SE 470 Software Development Processes
- SE 472 Personal Software Process
- SE 473 Security Architecture I
- SE 477 Software and Systems Project Management
- SE 480 Software Architecture
- SE 482 Requirements Engineering
- SE 529 Software Risk Management
- SE 531 Formal Software Specifications and Development II
- SE 533 Software Validation and Verification
- SE 540 Software Development for Mobile and Wireless Systems

SE 542 Software Development for Limited and Embedded Devices
SE 546 Software Architecture and Design for Desktop Applications
SE 550 Distributed Software Development
SE 552 Concurrent Software Development
SE 554 Enterprise Component Architecture
SE 558 Software Methodologies
SE 560 Structured Document Interchange and Processing
SE 567 Software Reliability
SE 571 Software Maintenance
SE 573 Security Architecture II
SE 580 Design of Object-Oriented Languages
SE 590 Advanced Topics in Object Oriented Technology

DePaul University's Software Engineering Program is an IEEE Computer Society registered Education Provider. DePaul University's Software Engineering Program is committed to enhancing the ongoing professional development of software development professionals, Certified Software Development Professionals (CSDP®), and other software stakeholders through appropriate software engineering learning activities and products. As a CSDP Education Provider, DePaul University's Software Engineering Program has agreed to abide by IEEE Computer Society established operational and educational criteria, and is subject to random audits for quality assurance purposes.

Advice given by DePaul University faculty and staff about CSDP recertification is for informational purposes only. This document may not reflect the most recent requirements for CSDP recertification.

COURSES

Please visit Campus Connection at <https://campusconnect.depaul.edu> for current course information.

If you do not have a password for Campus Connection you may log on as a guest. Once you are on Campus Connection please select Course Descriptions followed by the department.

THE VINCENTIAN CHARACTER OF DEPAUL UNIVERSITY

DePaul, a Catholic university, takes its name from St. Vincent dePaul. 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 dePaul.

GRADUATE ASSISTANTSHIPS

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.

