Foreword

Purpose of the IIT Graduate Bulletin

This bulletin describes the academic programs and resources, policies, procedures and student services in effect at the time of publication. It serves as a primary source of information for graduate students, faculty and administration. Prospective students and others can also use these sections to gain an understanding of the university its history, its campus setting, its campus life, etc., as a whole.

The programs described in this bulletin are applicable to those students who enter Illinois Institute of Technology (IIT) in the academic years 2010-2011 and 2011-2012. Students follow the programs described in the bulletin in effect at the time of their first registration.

Changes in programs and policies often occur before a new bulletin is published. A faculty advisor from the student's major department is the best source for current curriculum information. Updates are also listed on **www.iit.edu/graduate_college/**. The graduate dean's office can also refer students to the appropriate administrative office for current policies and procedures.

IIT's intention is to act in accordance with all regulations of the federal, state and local governments with respect to providing equality of opportunity in employment and in education, insofar as those regulations may pertain to IIT. IIT prohibits and will act to eliminate discrimination on the basis of race, color, religion, national origin, sex, age, handicap or veteran status.

Any student, applicant or employee of IIT who believes that he or she has received inequitable treatment because of discrimination violating IIT's stated policy of equal opportunity in employment and in education should communicate, either in writing or in person, with the director of equal opportunity programs in Room 223 of Perlstein Hall on IIT's Main Campus.
Descriptions of undergraduate programs and courses are in the IIT Undergraduate Bulletin; descriptions of law programs and courses are in the Chicago-Kent College of Law Bulletin.

Note: The information in this bulletin is subject to change without notice.

Published by Illinois Institute of Technology, Graduate College, 3300 S. Federal St., Chicago, IL 60616-3793, www.iit.edu.

Contents

Foreword . . . 1
Calendar . . . 4
The University . . . 6
The Colleges of the Illinois Institute of Technology . . . 6
Campus Resources . . . 11
Graduate Degree Programs and General Requirements . . . 24
Admission . . . 29
Academic Policies for Continuation of Studies . . . 37
Master's and Doctoral Examinations . . . 42
Completion of Studies and Graduation . . . 45
General Policies . . . 48
Expenses and Financial Assistance . . . 49
Academic Programs . . . 55
- Department of Applied Mathematics . . . 56
- School of Applied Technology . . . 69
- College of Architecture . . . 71
- Department of Biological, Chemical, and Physical Sciences . . . 92
- Department of Biomedical Engineering . . . 119
- Department of Chemical and Biological Engineering . . . 126
- Chicago-Kent College of Law . . . 145
- Department of Civil, Architectural and Environmental Engineering . . . 156
- Department of Computer Science . . . 177
- Institute of Design . . . 195
- Department of Electrical and Computer Engineering . . . 205
- Energy/Environment/Economics . . . 234
- Food Safety and Technology . . . 239
- Industrial Technology and Management . . . 246
- Information Technology and Management . . . 253
- Intellectual Property Management and Markets . . . 270
- Department of Mathematics and Science Education . . . 271
- Department of Mechanical, Materials, and Aerospace Engineering . . . 281
- Institute of Psychology . . . 299
- Stuart School of Business . . . 313
- Technical Communication . . . 345

Board of Trustees . . . 357
Administration . . . 359
Faculty Emeriti . . . 366
Campus Maps . . . 368
Directions . . . 369
Faculty Index . . . 370
Index . . . 372

Calendar

Academic Calendar for Fall	Fall 2010	Fall 2011	Fall 2012
Fall classes begin	Aug 23	Aug 22	Aug 20
Last day to add/drop with 100% tuition refund	Sept 3	Sept 2	Aug 31
Labor Day holiday	Sept 6	Sept 5	Sept 3
Fall degree conferral applications due	Sept 13	Sept 12	Sept 10
Spring and Summer incomplete grades due	Oct 4	Oct 3	Oct 1
Fall break	Oct 11	Oct 10	Oct 6
Midterm grades due	Oct 22	Oct 21	Oct 19
Spring and Summer class schedule published	Oct 25	Oct 24	Oct 22
Last day to withdraw	Nov 1	Oct 31	Oct 29
Spring registration begins	Nov 8	Nov 7	Nov 5
Thanksgiving break begins	Nov 24	Nov 23	Nov 21
Last day of Fall classes	Dec 4	Dec 3	Dec 1
Final exams begin	Dec 6	Dec 5	Dec 3
Final grades due at noon	Dec 15	Dec 14	Dec 12
Fall degree conferral	Dec 20	Dec 19	Dec 17

Academic Calendar for Spring	Spring 2011	Spring 2012	Spring 2013
Spring classes begin	Jan 10	Jan 9	Jan 14
MLK Jr. holiday	Jan 17	Jan 16	Jan 21
Last day to add/drop with 100% tuition refund	Jan 21	Jan 20	Jan 25
Spring degree conferral applications due	Jan 31	Jan 30	Feb 4
Fall incomplete grades due	Feb 21	Feb 20	Feb 25
Midterm grades due	Mar 11	Mar 9	Mar 15
Spring break begins	Mar 14	Mar 19	Mar 18
Fall class schedule published	Mar 21	Mar 26	Mar 25
Last day to withdraw	Mar 28	Apr 2	Apr 1
Summer and Fall registration begins	Apr 4	Apr 9	Apr 8
Graduate Salute begins	Apr 18	Apr 16	Apr 15
Commencement RSVPs due	Apr 20	Apr 18	Apr 17
Last day of Spring classes	Apr 30	Apr 28	May 4
Final exams begin	May 2	Apr 30	May 6
Final grades due at noon	May 11	May 9	May 15
Spring degree conferral and Commencement	May 14	May 12	May 18

Academic Calendar for Summer	Summer 2011	Summer 2012	Summer 2013
Summer classes begin	May 23	May 21	May 28
Last day to add/drop with 100% tuition refund	May 27	May 25	Jun 3
Memorial Day holiday	May 30	May 28	May 27
Summer degree conferral applications due	Jun 3	Jun 1	Jun 7
Midterm grades due	Jun 17	Jun 15	Jun 21
Last day to withdraw	Jun 27	Jun 25	Jun 28
Independence Day holiday	July 4	July 4	July 4
Last day of Summer classes/exams	July 16	July 14	July 20
Final grades due at noon	July 20	July 18	July 24
Summer degree conferral	July 23	July 21	July 27

Objective of Education at IIT

To provide post-baccalaureate education and research programs that enhance students' fundamental knowledge of their chosen field.

To educate and mentor graduate students to function in a global community with an appreciation of the economic, environmental, and social forces that impact professional choices.

To strengthen IIT's leadership role in higher education by focusing on the core research competencies and enhancing partnerships with industry, government laboratories, and academic and research institutions.

Accreditation

IIT is accredited by the North Central Association of Colleges and Secondary Schools. Specific professional curricula are accredited by the Engineering Accreditation Commission and the Computing Accreditation Commission of the Accreditation Board for Engineering and Technology, American Psychological Association, Council on Rehabilitation Education, American Bar Association, Association of American Law Schools, The Association to Advance Collegiate Schools of Business, and National Architectural Accrediting Board.

The Colleges of Illinois Institute of Technology

Graduate College

Ali Cinar, Dean and Vice Provost for Research
301 Main Building
3300 S. Federal St.
Chicago, IL 60616
312.567.3024
www.iit.edu/graduate_college/

The Graduate College coordinates the programs of advanced study offered by the academic units of the university. The college consists of the following offices: Office of the Dean and Vice Provost for Research; Office of Academic Affairs; Office of Sponsored Research and Programs; Office of Research Compliance and Proposal Development; Graduate Enrollment; and the Office of Editorial Assistance (Thesis Examiner). The dean chairs the Graduate Studies Committee and the Research Council, sets minimum standards for graduate students, represents the university in national forums for graduate education, and serves as an advocate for promoting graduate education and research across the university.

29 separate Master of Science (M.S.) degrees, which typically include a thesis requirement, are offered. The professional Master's (MAS) degree, which does not require a thesis, has 48 separate offerings. Doctoral degrees (Ph.D.s) are offered in 22 fields.

School of Applied Technology

C. Robert Carlson, Dean
Daniel F. and Ada L. Rice Campus
201 East Loop Road
Wheaton, IL 60187
630.682.6000
www.cpd.iit.edu

The School of Applied Technology (SAT) offers technology-oriented training and education for working professionals. Courses are taught by IIT professors and industry professionals with significant working, teaching and research experience in their fields. The IIT School of Applied Technology offers education and training in a wide variety of formats including degree, non-degree, certificate, credit and noncredit programs; corporate training; short courses; and seminars ranging from a few hours to several days in length. Completion of all IIT School of Applied Technology non-credit courses will result in the assignment of Continuing Education Units (CEU) fully accredited by the International Association for Continuing Education and Training (IACET).

The IIT School of Applied Technology offers undergraduate degree programs in Information Technology and Management, and Industrial Technology and Management; graduate programs in Information Technology and Management, and Industrial Technology and Operations; undergraduate certificates in Manufacturing Technology and Management and Training the Technical Trainer; graduate certificates in a variety of topics in information technology; Professional Engineer (PE)/Engineering Intern (EI) Review courses and continuing education courses for Professional Engineers; and a wide variety of non-credit semester-length and short courses in all disciplines. Through IIT Online, the School of IIT School of Applied Technology markets and manages online delivery of IIT degree and non-degree offerings in all disciplines.

College of Architecture

Donna Robertson, Dean
John and Jeanne Rowe Chair
S. R. Crown Hall
3360 South State Street
Chicago, IL 60616
312.567.3230
www.arch.iit.edu

The program in architecture was established at Armour Institute of Technology, one of IIT's predecessors, in 1895. In 1938, the program came under the directorship of the world-renowned architect and educator Ludwig Mies van der Rohe. The college is housed in S.R. Crown Hall, one of Mies' most significant buildings and a major contribution to Chicago's rich architectural heritage. The college emphasizes applied studio work under the tutelage of a faculty of practicing architects; the study of architectural theory; interdisciplinary learning; and international study.

Armour College of Engineering

Natacha DePaola, Dean
Carol and Ed Kaplan Armour Dean of Engineering
Engineering 1 Building, Suite 220
10 W. 32nd St.
Chicago, IL 60616
312.567.3009
www.iit.edu/engineering/

The IIT Armour College of Engineering traces its roots to Armour Institute, founded in 1892 to prepare students of all backgrounds for leadership roles - primarily as engineers - in a challenging industrial society. Armour College carries on that tradition of excellence in engineering education and research.

Today, Armour College is home to about 90 full-time faculty, more than 2,500 undergraduate and graduate students, and the graduate and undergraduate programs of five engineering departments.

Undergraduate degrees offered by Armour College are accredited by the Engineering Accreditation Commission of the Accreditation Board of Engineering and Technology. All IIT graduate and undergraduate programs are also accredited by the North Central Association (NCA).

The mission of the Armour College of Engineering is to: provide state-of-the-art education and research programs that enhance Armour's reputation as an internationally recognized engineering school; educate a new breed of engineers with a strong fundamental knowledge of engineering principles and an understanding and appreciation of the economic, environmental, and social forces that impact intellectual choices; and strengthen Armour's leadership role by focusing on the core research competencies and enhancing partnerships with industry, government laboratories, and academic and research institutions.

Chicago-Kent College of Law

Harold J. Krent, Dean
Downtown Campus
565 West Adams Street
Chicago, IL 60661
312.906.5000
www.kentlaw.edu

Chicago-Kent College of Law is the second-oldest law school in Illinois. When it joined the university in 1969, IIT became the first major institute of technology to include law among its disciplines. Chicago-Kent offers programs leading to the degrees of Juris Doctor and Master of Laws and participates in joint-degree programs with Stuart School of Business.

Institute of Design

Patrick F. Whitney, Dean
350 N. LaSalle St., Fourth Floor
Chicago, IL 60610
312.595.4900
www.id.iit.edu

The Institute of Design (ID), which was founded by Laszlo Moholy-Nagy in 1937 as the New Bauhaus, merged with IIT in 1949. Since its founding, it has grown into the largest full-time graduate design program in the U.S., and was the first school in the country to create a Ph.D. program in design.

The Institute of Design offers a Doctor of Philosophy (Ph.D.) research degree, a Master of Design (M.Des.) professional degree, and a Master of Design Methods (M.D.M.) for mid-career designers seeking advanced new methods.

Institute of Psychology

M. Ellen Mitchell, Dean
252 Life Sciences Building
3101 S. Dearborn St.
Chicago, IL 60616
312.567.3500
www.iit.edu/colleges/psych

Established in 1995, the Institute of Psychology was created from the Department of Psychology, previously housed within IIT's Lewis College of Liberal Arts. It is noted for its applied graduate programs in clinical, industrial/ organizational and rehabilitation psychology. It offers an undergraduate program that is focused on psychology as a science linked to the professions.

College of Science and Letters

R. Russell Betts, Dean
125 E1
10 W. 32nd St.
Chicago, IL 60616
312.567.3800
www.iit.edu/csl

The College of Science and Letters was formed in 2003 with the following departments: Applied Mathematics; Biological, Chemical and Physical Sciences; Computer Science; Humanities; Mathematics and Science Education; and Social Sciences. The graduate mission of the college is to deliver superior educational and research opportunities M.S. and Ph.D. degree programs as well as certificate, professional masters, and short-course programs.

Stuart School of Business

Harvey Kahalas, Dean
Downtown Campus
565 W. Adams St.
Chicago, IL 60661

Main Campus
3424 S. State St.
1GT-Central Rm. 4A5-1
Chicago, IL 60616

312.906.6500
www.stuart.iit.edu

IIT Stuart School of Business provides intellectually rigorous business and management education at all levels, from baccalaureate to doctoral. All IIT Stuart programs are designed to educate tomorrow's global innovators through the unique concept of strategic competitiveness. Constructs including creativity, innovation, entrepreneurship, incisive decision-making, leadership, and sustainability are interwoven throughout coursework and professional development opportunities, offering students thorough preparation for the challenges of the Next Economy.

IIT Stuart was established in 1969 with a gift from IIT alumnus and noted financier Harold Leonard Stuart. The school houses the Knapp Entrepreneurship Center, the Center for Financial Markets, the Center for the Management of Medical Technology, the Center for Strategic Competitiveness, and the Center for Sustainable Enterprise.

IIT Stuart offers the following degrees: B.S. in Business Administration, B.S. in Business Administration and Applied Science, M.B.A, Masters of Mathematical Finance (M.M.F.), M.S. in Environmental Management and Sustainability, M.S. in Finance, M.S. in Marketing Communication, Master of Public Administration, and Ph.D. in Management Science. A series of dual degrees with IIT's Chicago- Kent College of Law and IIT's Institute of Design are also offered, as well as numerous Graduate Certificate Programs.

IIT History and Campuses

IIT's traditions span more than a century of innovation and educational leadership. IIT came into being in 1940 with the merger of Armour Institute of Technology (founded in 1892) and Lewis Institute (founded in 1896).

Today, the university has several campuses and offers degree programs through the College of Architecture, Armour College of Engineering, Chicago-Kent College of Law, Institute of Design, Center for Professional Development, Institute of Psychology, College of Science and Letters, and Stuart School of Business.

The 120-acre Main Campus is located three miles south of the central business district in Chicago, and is internationally known for its architecture. The Master Plan of the campus and many of its 50 buildings were developed by Ludwig Mies van der Rohe, one of the century's most influential architects, and his students.

IIT's Downtown Campus, at 565 W. Adams St. in the West Loop business district, houses the Chicago-Kent College of Law, Stuart School of Business, and Master of Public Administration program. A shuttle-bus provides transportation between the Main and Downtown campuses. The Stuart School's M.B.A. program is also offered at IIT's Rice Campus.

The Institute of Design moved in January 1998 to 350 N. LaSalle St. The move provides the institute with an outstanding downtown location and state-of-the-art facilities.

The Daniel F. and Ada L. Rice Campus, at 201 E. Loop Road in Wheaton, IL, is IIT's west-suburban location. Graduate and upper-division undergraduate courses and degree programs are available at the Rice Campus via evening and Saturday classes, and via courses broadcast live through IIT Online.

The School of Applied Technology offers degree programs in information technology and management, and in industrial technology and operations, non-credit short courses, and information technology training programs.

IIT Online delivers courses via the Internet and links classroom studios on campus with remote TV receiving sites. IIT Online's talk-back feature permits students in receiving classrooms to participate in class discussions. IIT has 19 receiving sites throughout the Chicago area.

Moffett Campus, in southwest-suburban Summit-Argo, houses the National Center for Food Safety and Technology (NCFST), a multidisciplinary food safety research facility, which is funded by the U.S. Food and Drug Administration and the food industry. Established with a gift from CPC International, Inc., the campus has enabled the university to develop academic programs in food safety and technology. Courses leading to master's degrees and a certificate program in food safety and technology, and in food process engineering, are offered at this facility.

Chicago and its Environs

Chicago is world-renowned for its museums and architecture, and offers exceptional career and internship opportunities in all of IIT's fields of study. The city and its surroundings form an international center of finance and law, a manufacturing and transportation hub, and the home of two national research laboratories (Argonne National Laboratory and Fermi National Accelerator Laboratory), as well as numerous medical facilities and corporate headquarters.

Diversions range from a world-class symphony orchestra to major league sports teams. Located on the southwestern shore of Lake Michigan, Chicago boasts miles of attractive beaches and parks for jogging, biking, swimming and boating. Ethnic neighborhoods throughout the city provide an international array of cultures and cuisine. Chicago is also rich in live theater, and music clubs abound.

A Snapshot of the IIT Community

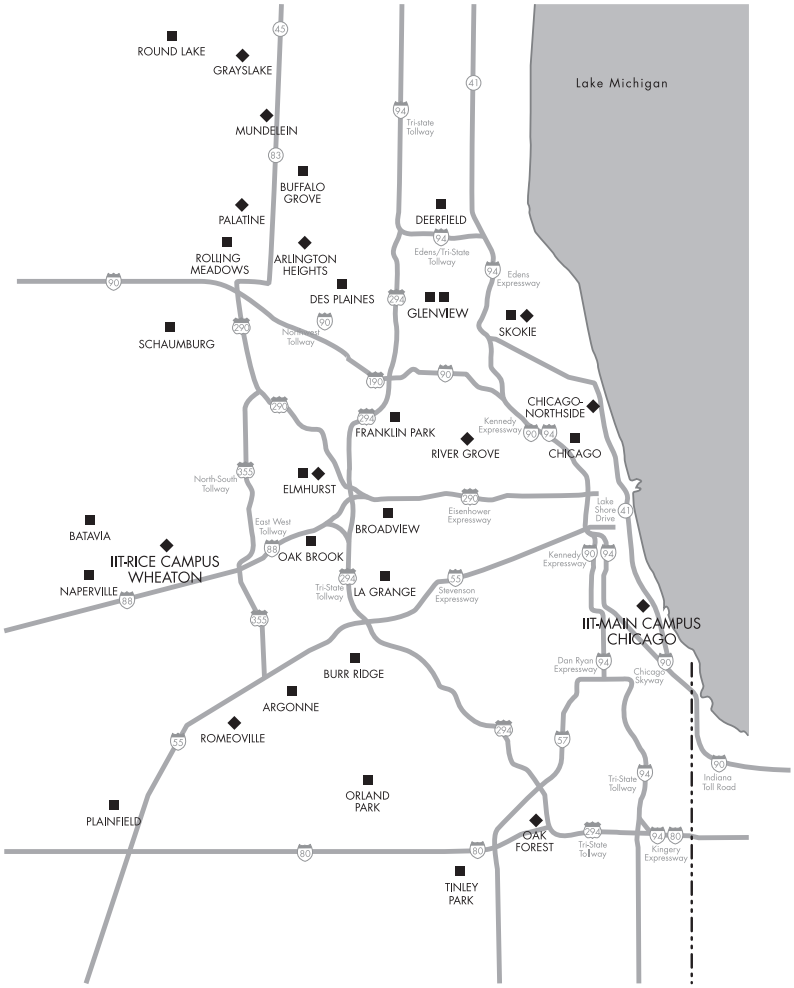
Enrollment (Fall 2009)		Student Demographics		Degrees Awarded 2008-2009	
Undergraduate	2665 students	Male	65%	Bachelor	471
Graduate	3242 students	Female	35%	Master	1478
Law	1116 students	Minority*	16%	First Professional	287
Business	684 students	International	38%	Ph.D.	77
Total	7707 students	Countries of Origin	109	Certificates	33
		Student/Faculty Ratio	10:1	**Total**	2346

* Includes African American, Asian American, Hispanic American, and Native American

IIT Online Receiving Sites

Sites are subject to change. For a current list of IIT Online viewing sites and a detailed map of those public and corporate viewing sites, students should contact IIT Online by e-mail at online.clientsvc@iit.edu or visit www.iit-online.iit.edu.

IIT Online is IIT's distance education unit, delivering courses via the Internet and by live televised course broadcasts to public and corporate viewing sites. A "public" viewing site is a location where students registered for the appropriate section of a course may view that course live; a "corporate" site is for the use of employees of the corporation.



■ Corporoate Sites

Argonne National Laboratory
Baxter Healthcare Corporation (Round Lake)
Fermi National Accelerator Laboratory (Batavia)
Kraft Foods, Research and Development (Glenview) Internet Only
Motorola, Inc. (Schaumburg)
MPC Products (Skokie)
Northrop Grumman Corporation (Rolling Meadows)
Panduit Corporation (Tinley Park)
Tellabs (Naperville)
The Chamberlain Group, Inc. (Elmhurst)
UOP, Inc. (DesPlaines)

◆ Public Sites

Elmhurst College (Elmhurst)
Harry S Truman College (Chicago)
IIT Daniel F. and Ada L. Rice Campus (Wheaton)
Joliet Junior College, North Campus (Romeoville)
Oakton Community College, Ray Harstein Campus (Skokie)
South Suburban College University & College Center (Oak Forest)
Triton College (River Grove)
William Rainey Harper College (Palatine)

Academic Resource Center

The Academic Resource Center (ARC) is a comprehensive learning center with a variety of services for students and faculty. Our mission is to enrich the academic experience through a student-centered approach to learning. The ARC tutors in math and the sciences.

Undergraduate and graduate peer tutors are available during the fall and spring semesters on a drop-in basis. In addition to peer tutoring, the ARC offers exam reviews, group study space, and a computer laboratory.

The ARC is located in the Northwest Corner of the Hermann Hall Building. The ARC is open Monday-Thursday 10 a.m. to 8 p.m., Friday 10 a.m. to 3 p.m., and Sunday from 6 p.m. to 9 p.m. For more details please visit the ARC website: http://arc.iit.edu.

Access, Card, and Parking Services

The Access, Card, and Parking Services Office issues HawkCards and parking permits for the university. The HawkCard is the picture identification card for IIT students, staff, and faculty. Not only does it serve as an ID, it also grants access to buildings, parking lots, computer labs, Keating Athletic Center, the shuttle bus, library materials' check-out services, and HawkCash balances. Permits to park in IIT lots are available for purchase on an annual, academic year, or semester basis. Students should visit Access, Card, and Parking Services in Herman Hall, Room 201 for more information, or visit www.hawkcard.iit.edu or www.parking.iit.edu.

Athletics and Recreation

The Department of Athletics and Recreation offers a comprehensive program of varsity sports, intramural competition, instruction and informal recreational activities for both men and women. The Scarlet Hawks men's varsity teams compete in intercollegiate baseball, basketball, cross-country, soccer, and swimming; women's varsity teams compete in cross-country, swimming, basketball, soccer, and volleyball. The university is an active member of the National Association of Intercollegiate Athletics (NAIA). For non-varsity athletes, intramural teams provide spirited competition in basketball, handball/ squash, cricket, racquetball, softball, tennis, touch football, swimming, cross-country, and volleyball. Recreational activities, open swimming, and open freeplay activities are all available. For more information, please visit www.iit.edu/˜athletic.

Career Management Center

Located on the upper level of the Galvin Library, the Career Management Center (CMC) offers individual career advising and testing, resume critiques, job search assistance, mock interviews, and labor market and salary data for students and alumni. The CMC also administers the Cooperative Education and Internship Programs, from which qualified students gain experience in their field of study prior to graduation. Both programs are options for domestic and international students at the undergraduate and graduate levels.

The CMC conducts a variety of professional development workshops on topics including resume and cover letter writing, job search strategies, and interviewing skills. The CMC also hosts semiannual career fairs, employer information sessions, and on-campus interviews. Career related resources, articles, workshop schedules and a link to job postings may be accessed by students and alumni registered in NACELink (www.cmc.iit.edu). Individual sessions with a career advisor may be scheduled by appointment at 312.567.6800.

Communication Across the Curriculum Program

The CAC helps students understand the role of writing and speaking in their academic and professional lives. Both on its website (www.iit.edu/cac/) and in the CAC Writing Center, located in Siegel Hall 232, the CAC provides assistance in communication skills for academic inquiry, professional research, and the workplace. The CAC also assists IIT instructors in developing materials relevant to written, oral, electronic, and interpersonal communication in discipline-specific courses, particularly Introduction to the Profession (ITP), writing-intensive (C-Courses), and Interprofessional Projects (IPROs). The CAC director also administers IIT's Basic Writing Proficiency requirement.

Commuter Student Services

IIT's commuter student organization, Commuter Students Association, informs commuter students about available student services and serves as a place where commuter students get to know one another and voice their concerns. The group also plans a variety of events and activities throughout the year. For more information on CSA's programming, students should consult the Office of Student Activities in the McCormick Tribune Campus Center.

Cooperative Education Program

Cooperative education (co-op) is a learning approach that integrates college studies with professional work experience in industry, business, or government. Salaries among IIT co-op students are competitive and help defray educational expenses. The co-op experience improves employment opportunities upon graduation. Full-time IIT graduate students who have completed two semesters at IIT and who have maintained good academic standing are eligible to apply for the co-op program. Some academic departments may have additional conditions for the approval of co-ops, such as the completion of specific course requirements, these conditions may be found in the departments webpages and departmental documents.

Interested students must attend an Introduction to Cooperative Education and Internship Workshop conducted by the CMC and the International Office.

For more information, contact the CMC at 312.567.6800 or visit www.cmc.iit.edu.

Disability Resources

Services for persons with disabilities are coordinated by the Center for Disability Resources. Persons with disabilities who are interested in applying for admission to any of IIT's educational programs are invited to call the center prior to their arrival on campus to discuss their individual needs. Enrolled students with disabilities are encouraged to consult the office regarding classroom accomodations and access to IIT facilities.

International Center

The International Center (www.iit.edu/~internat/) promotes international education and cultural exchange by: supporting international students, faculty and staff, as well as students studying abroad; assisting in the compliance of immigration and other related regulations; and providing services and resources to the IIT community. These services include: individual and group orientation to the university and community; information and advice on immigration regulations; assistance with document preparation for employment and other related non-immigrant benefits; and information and advice on study abroad programs. All international students, faculty and staff must report to the International Center immediately upon arrival at IIT.

Interprofessional Projects

The Interprofessional Projects (IPRO) Program coordinates the IPRO course, a general education requirement for all undergraduates and a possible elective for graduate students. The IPRO course organizes students in semester-long multidisciplinary project team sections based on contemporary problem-solving challenges that are proposed by students, faculty members and sponsoring organizations that reflect the diversity of the workplace: corporations, entrepreneurial ventures, nonprofit organizations and government agencies. The IPRO teams are self-directed, offering terrific opportunities for developing leadership potential and collaborating on interesting technical, business and social challenges with faculty and sponsor mentors. Entrepreneurial IPRO (EnPRO) teams address the added challenge of developing a technological entrepreneurship opportunity analysis that can lead to a business plan for a new venture concept. IPRO teams may include five to 15 students from all academic levels (sophomore through graduate school), and across IIT's professional programs (applied technology, architecture, business, design, engineering, law, political science, technical communication, psychology, and the sciences). Integrating these perspectives within a project team stimulates student and faculty interaction across the boundaries of individual disciplines and experiences. Learn more and review the current or future course listings by visiting http://ipro.iit.edu or the IPRO Program Office at 3424 South State Street, Central Building, 4th Floor.

Multicultural Student Services

Serving as the primary office for students' personal and professional development, OMSS is an ally for domestic students of color, women, LGBT, and other diverse populations. We provide a variety of programs and services that address culture, history, policy, values, and belief systems. Through these programs we promote and celebrate diversity and equality.

All students, faculty, staff, alumni, and friends of the University are welcome to partner with OMSS in advancing its efforts to support diversity.

Some of the support and services our office offers to students:

- Educational & Cultural Programs
- Personal and Professional Development/ Guidance
- Student Networking Events
- Academic Book Loan Program
- Lending Library
- "Voices of Diversity" Newsletter
- Resources on Culture and Diversity
- Minority Scholarship Information
- Cultural Events Calendar (Announcement for off-campus events)
- A Safe Space
- & Always an OPEN door

Libraries

IIT's libraries include Paul V. Galvin Library; the Center for the Study of Ethics in the Professions (Main Campus); the Graham Resource Center (Main Campus); the Louis W. Biegler Library (Rice Campus); the National Center for Food Safety & Technology Library (Moffett Campus); the Downtown Campus Library, serving the Chicago-Kent College of Law and the Stuart School of Business; and the IIT Archives (Main Campus).

Paul V. Galvin Library
library.iit.edu
312.567.3616

As the university's central library, Paul V. Galvin Library combines cutting-edge information technology with traditional library services. The library's holdings include more than 1.1 million volumes, including books, journals, government publications, and microforms. Digital services provide 24-hour Internet access to more than 100 electronic databases indexing millions of journal articles; over 25,000 full text electronic journals; electronic course reserves; and I-Share, a statewide resource sharing consortium of more than 75 academic libraries. Additionally Galvin Library provides web-based delivery of a variety of materials, including documents requested via interlibrary loan. The library's instruction program serves the IIT community by teaching skills needed to locate, retrieve, and evaluate information. Library instructors teach at all levels from introductory to advanced and cover a broad range of all types of information and retrieval techniques. Library workshops are offered regularly throughout a semester or can be specifically tailored for a course or program by library subject specialists.

Graham Resource Center
library.iit.edu/grc
312.567.3256

A branch of the Paul V. Galvin Library, the Graham Resource Center (GRC) serves as the subject-specific library for the College of Architecture students and faculty. Housed in Crown Hall, the GRC collection includes more than 15,000 books, 50 journal titles, and a number of online resources to support curriculum goals and meet research and refernce needs. The GRC staff can assist Architecture faculty and students with reference, instruction, and course reserves.

Center for the Study of Ethics in the Professions (CSEP) Library
library.iit.edu/csep
312.567.6913

The Center, located in Hermann Hall, contains a variety of materials dealing with topics in practical and professional ethics, such as autonomy, confidentiality, conflict of interest, and self regulation. The library provides bibliographic assistance to researchers and assists visiting scholars and practitioners.

Louis W. Biegler Library
library.iit.edu/biegler
630.682.6050

The Louis W. Biegler Library, a branch located at the Rice Campus in Wheaton, provides access to a circulating collection, reserve materials, and journals, as well as access to digital resources. Services for distance learners are coordinated at Biegler, and include interlibrary loan, web-based document delivery, research and reference consultations, and library instruction.

National Center for Food Safety & Technology Library
library.iit.edu/ncfst
708.563.8163

Located on IIT's Moffett Campus in Summit, the NCFST branch library supports research on food technology and food safety. A depository library for the FAO (Food and Agriculture Organization of the United Nations), the library provides digital access to all of the Galvin Library databases, as well as services such as interlibrary loan, web-based document delivery, and library instruction.

Downtown Campus Library
library.kentlaw.edu
312.906.5600

Serving the Chicago-Kent College of Law and IIT's graduate business program, the Downtown Campus Library (DTC) also includes an extensive collection of U.S. Government, United Nations and European Union documents. The DTC library provides access to digital resources, as well as services such as reference, instruction and interlibrary loan.

Research Centers

Center for Accelerator and Particle Physics (CAPP)
The Center for Accelerator and Particle Physics (CAPP) provides a locus for interdisciplinary activities at IIT aimed at the continued development of research in elementary particle physics, at developing new particleaccelerator technologies, and at education and outreach to educational institutions and to the wider business, philanthropic and general public sectors. It serves as a base to coordinate the activities of a group of IIT faculty, graduate students, and staff from various departments currently involved in a number of research programs, and will promote substantial increases in such involvement through a close working relationship with other universities in the region and with Fermilab and Argonne National Laboratory (ANL). Daniel Kaplan, Director, can be reached at 312.567.3389 or at kaplan@iit.edu. Web: www.capp.iit.edu.

Center for Complex Systems and Dynamics (CCSD)
The Center for Complex Systems and Dynamics (CCSD) provides an interdisciplinary collaborative environment for fundamental and applied research for understanding and mathematically describing complex systems; developing mathematical and computational techniques for simulating, analyzing, and modifying their behavior; and applying these methods to various complex systems of national interest. Current research areas include nonlinear and stochastic phenomena in complex systems, multiagent systems, complex networks and adaptive systems, natural and industrial ecologies, dynamics of multiphase systems, fluid turbulence, molecular level modeling of physical systems, brain electrophysiology and computational neuroscience, and transportation systems. Fouad Teymour, Director can be reached at 312.567.8947 or teymour@iit.edu. Web: www.ccsd.iit.edu.

Center for Diabetes Research and Policy (CDRP)
The Center for Diabetes Research and Policy (CDRP) is a multi-disciplinary that includes scholars from engineering, scientific, social scientific, and legal fields. Currently, IIT's Engineering Center for Diabetes Research and Education (ECDRE); Institute for Science, Law and Technology (ISLAT); and Health and Disability Law Clinic in the Law Offices of Chicago-Kent College of Law (the Health Law Clinic) focus on various aspects of diabetes research, prevention, diagnosis, and treatment. The Center unites these entities to undertake scientific research, make policy assessments and recommendations, and provide legal advice for individuals with diabetes-related conditions who are participating in research, seeking access to care, or have been discriminated against because they have or are likely to develop diabetes. It also undertakes research into understanding the disease's mechanisms, designing new treatments, and discovering methods of monitoring and treating the complications of the disease. The CDRP collaborates with community and professional groups to increase education, awareness, and prevention.

Center for Electrochemical Science and Engineering
The Center for Electrochemical Science and Engineering conducts basic and applied research primarily in fuel cells and batteries, while preparing students for a career in advanced energy technology. Jai Prakash, Director, can be reached at 312.567.3639. Web: www.chee.iit.edu/research/cese/cese.htm.

Center of Excellence in Polymer Science and Engineering
The Center of Excellence in Polymer Science and Engineering is an interdisciplinary research and education center established in 1990 through a grant from the Amoco Foundation, is devoted to the advancement of polymer science and engineering. Research is conducted on synthesis, rheology, characterization and processing of polymers. Education programs include concentrations for B.S., MAS (non-thesis), M.S. and Ph.D. degrees. David Venerus, Director, can be reached at 312.567.5177 or venerus@iit.edu. Web: www.chbe.iit.edu/research/cepse.

Center for Integrative Neuroscience and Neuroengineering Research (CINNR)
The Center for Integrative Neuroscience and Neuroengineering Research (CINNR)'s mission is to foster research in systems and behavioral neuroscience at the University of Chicago and neural engineering at Illinois Institute of Technology. Work in the Center proceeds from basic science and clinical efforts and emphasizes interdisciplinary approaches to understanding the nervous system. Philip Ulinski, Director, can be reached at 773.702.8081 or pulinski@uchicago.edu. David Mogul, Co-Director can be reached at 312.567.3873, or mogul@iit.edu. Web: www.cinnresearch.org.

Center for the Management of Medical Technology (CMMT)
The Center for the Management of Medical Technology (CMMT) is dedicated to research, education and dissemination of knowledge in the management of medical technology. The CMMT has five major research thrusts: generation, adoption and utilization of medical technologies; the nature of medical technology and innovation and the role it plays in health care delivery; evaluation of medical technologies; ethics, social implications and patient value of medical technologies, and management of medical information and emerging technologies. Eliezer Geisler, Director, can be reached at 312.906.6532.

Manufacturing Productivity Center (MPC)
The Manufacturing Productivity Center (MPC) was established in 1976 to provide a link between local industry and the resources of IIT Center. The center's specialization includes manufacturing technology, industrial logistics, and industrial facilities. MPC provides Chicagoland industry with access to Illinois Institute of Technology faculty, students and staff. Dr. Mazin Safar, Director can be reached at 312.567.3650 or safar@iit.edu

Center for the Molecular Study of Soft Condensed Matter (μCoSM)
The center for molecular study of condensed soft matter (μCoSM) is a multi-disciplinary center dedicated to the research of soft matter, both biological and synthetic. The center has substantial expertise in cell membranes, collagen, ECM, peptide mimetics, entangled polymers, networks, and the cytoskeleton. Particular emphasis is paid to establishing molecular structure/property/function relationships. The center houses faculty from Biology, Engineering, and Physics, and is a member of the Pritzker Institute of Biomedical Science and Engineering. Research relies equally on experimental, computational, and theoretical components, including neutron diffraction, x-ray diffraction and scattering, atomic force microscopy, Forced Rayliegh Scattering, micro- and bulk rheology, molecular dynamics simulations, and stochastic and statistical mechanical modeling. Jay Schieber, Director, can be reached at 312.567.3046, or schieber@iit.edu. Web: www.iit.edu/ucosm/

Center for Strategic Competitiveness (CSC)
The Center for Strategic Competitiveness (CSC) is the nerve center for research and outreach activities of the Stuart School of Business, developing global partnerships to enhance innovation and creativity, and providing quality, high level executive education customized to meet discipline-specific demands. Our mission is develop Strategic Competitiveness into a approach to business that enhances the ability of individuals, organizations, and governmental units to respond proactively, innovatively and exceptionally to global market challenges in today's and tomorrow's economy.

The CSC provides a cross-discipline approach to competitiveness, combining psychology (decision making and leadership), design (creativity, innovation, and entrepreneurship), and engineering (sustainability). Our research and program efforts are developed within a network of partnerships, bringing together the knowledge and experience of executives, lawmakers, academics and experts in an array of fields. The CSC is tasked with the responsibility of making certain that the heart of the Stuart School of BusinessStrategic Competitivenessis always evolving and adapting to the present and future demands of global business. We do this, in part, through a major portfolio of research, symposia, public information, and public awareness of competitiveness issues developed in partnership with a variety of funders. Additionally, we provide training for individuals or groups through our custom executive education programs and course offerings, such as the Mini-MBA for Engineering, Science and Technology Professionals program. Harvey Kahalas, Director, can be reached at 312.567.3472 or kahalas@stuart.iit.edu

Center for the Study of Ethics in the Professions (CSEP)
The Center for the Study of Ethics in the Professions (CSEP) was established in 1976 to promote research and teaching on practical ethical issues in the professions. The first ethics center to focus on the professions, CSEP continues to be one of the nation's leading ethics centers and is internationally recognized for its work on ethics in science, engineering, and related areas of business. CSEP is committed to multi-disciplinary and multi-institutional research, to projects that combine empirical investigation with conceptual analysis, and projects that introduce and propagate innovations in teaching. Past projects have focused on such topics as intellectual property, decision-making involving engineers and managers, and ethics and societal implications of nanotechnology. There is a continuing emphasis on projects that integrate ethics education into technical courses, for example the development of methods of micro-insertion and Ethics Across the Curriculum. These latter projects have equipped CSEP for an expanding role in raising ethics awareness in all IIT's disciplines and professional programs. Vivian Weil, Director, can be reached at 312 567 3472 or weil@iit.edu. Web: http://ethics.iit.edu/.

Center for Synchrotron Radiation Research and Instrumentation
The Center for Synchrotron Radiation Research and Instrumentation promotes application of the tools and techniques of synchrotron radiation to science and engineering research, with a particular focus on developing experimental beam line facilities to serve the needs of various collaborative access teams at the Advanced Photon Source at Argonne National Laboratory. Tom Irving, Director, can be reached at 312.567.3489. Web: www.iit.edu/csrri/

Center for Work Zone Safety and Mobility (CWZSM)
The Center for Work Zone Safety and Mobility (CWZSM) works towards providing long-term solutions to highway work zone safety and mobility problems, by building a consortium of major work zone stakeholders including transportation agencies, road contractors, the trucking industry, and the insurance industry. By working together through the consortium, the stakeholders can combine their resources and knowledge, and work towards preventing the 50,000 work zone injuries and 1,000 fatalities that occur every year. The initiatives of the center focus on (1) developing highway work zone safety audit guidelines by addressing the concerns and interests of all stakeholders; (2) discovering/ developing/transferring new technologies and measures for improving work zone safety, and minimizing its negative impacts on private industries and the national economy; and (3) providing work zone safety training and education to the transportation community and the public. David Arditi, Director, can be reached at 312.567.3630 or arditi@iit.edu. Web: www.cwzsm.iit.edu.

Electric Power and Power Electronics Center (EPPEC)
IIT has long maintained high quality education and research programs in electric power and energy systems. The mission of the Electric Power and Power Electronics Center (EPPEC) is to make significant educational, research, and practical contributions to the fields of electric power, power electronics, electric machines, motor drives, and vehicular power systems. The tasks of the Center include the sponsorship of technical studies, which will enhance the role of university faculty, manufacturers, vendors, and consumers in power engineering research and education. The Center works with centers and departments across IIT, other institutions, government agencies, and industry to sponsor research projects, short courses, conferences, and seminars. Ali Emadi, Director, can be reached at 312.567.8940 or emadi@iit.edu. Web: http://power.iit.edu.

Energy +Power Center
Energy +Power Center offers research and education programs that respond to the needs of the energy and power industries. The center's activities include the Energy/Environment/Economics (E3) program.

Engineering Center For Diabetes Research and Education (ECDRE)
The Engineering Center For Diabetes Research and Education (ECDRE)'s objective is to use engineering and science-based techniques to develop treatment modalities for diabetes and its many complications. ECDRE is the first center in the U.S. to focus on diabetes treatment. IIT faculty members, in collaboration with investigators and clinicians at the University of Chicago and Argonne National Laboratory, are working on a variety of diabetes- related research projects. ECDRE is a component of the Pritzker Institute of Biomedical Science and Engineering, which is developing a biomedical research thrust on the campus of IIT. Ali Cinar, Director, can be reached at 312.567.3637 or cinar@iit.edu. Web: www.iit.edu/ecdcre/.

Fluid Dynamics Research Center
The Fluid Dynamics Research Center consists of six faculty engaged in experimental, computational, and analytical studies of fluid flow and its control. The center has numerous research-quality experimental facilities including, high and low Mach number wind tunnels, jet facilities, water channels, anechoic room and an axial flow compressor. Extensive computational resources are available for numerical flow simulations. Areas of focus include active flow control for aerospace applications, aeroacoustics, contaminant dispersion predictions and vortex-surface interactions. David R. Williams, Director, can be reached at 312.567.3192. Web: http://fdrc.iit.edu.

High Performance Computing Center (HPCC)
The High Performance Computing Center (HPCC) is based on the successful collaboration among Illinois Institute of Technology faculty and the Office of Technology Services. The HPCC serves a critical computing need among IIT researchers: the availability of high performance computing resources. In particular, the HPCC charter has three main goals: to provide expertise on the integration of new computing equipment into IIT's HPC pool; to attract external funding for HPC infrastructure; and to promote HPC at IIT. The HPCC oversees the university's central research computing resources: the 32 processor gigawulf Linux cluster. Alex Flueck, Director, can be reached at 312.567.3625 or flueck@iit.edu.

IIT Research Institute (IITRI)

IIT Research Institute (IITRI) is IIT's not-for-profit contract research affiliate. With a focus on biomedical research, IITRI's staff of approximately 115 scientists and technicians conducts programs for both government and commercial sponsors. Specific areas of expertise include preclinical toxicology; carcinogenesis and cancer prevention; inhalation technology; molecular biology; analytical chemistry; and biodefense. David McCormick, IITRI Senior Vice-President and Director, can be reached at 312.567.4972. Web: www.iitri.org.

International Center for Sensor Science and Engineering (ICSSE)

The International Center for Sensor Science and Engineering (ICSSE) coordinates education and research activities in sensor science and engineering. The center addresses significant national and international needs for research and development in sensor science. Current research activities include: biosensors, electrochemical sensors, nanosensors, physical sensors, computations for optimum sensor applications, pattern recognition and artificial intelligence in sensor systems, artificial chemical sensor arrays like electronic noses and tongues, prosthetic sensing like eyes, ears and noses, sensor modeling and design, the shared sensor technology user facility for extreme sensor evaluation, and sensors for chiral molecules. Sensor applications include medicine, environment, human health and safety, industrial and automotive, homeland security, and the NASA space station. William Buttner, Director, can be reached at 312.567.5875 or buttner@iit.edu. Web: www.icsse.iit.edu.

The International Center for Sustainable New Cities (ICSNC)

The dual foci of The International Center for Sustainable New Cities (ICSNC) are education and research. Situated within the graduate program of the College of Architecture, the center will offer coursework at both a graduate and doctoral level. Planning at the urban scale demands an especially ambitious approach that embodies not only the artistry of physical design but also a score of other specializations, among them ecological design, engineering and new technologies, public policy, sociology, and economics. Whereas it is unrealistic to expect to train students in each and every one of these disciplines, it is not unreasonable to view the sustainable urban planner as a generalist, as someone conversant with the multitude of variables that have to be taken into account in the successful completion of such an extended task. The issue of research is likewise central to the center's mission, particularly at a doctoral level. Within the realm of theory, it is our primary intention to consider critically a broad range of innovative strategies, and to document the matrix of competing interests and concerns that must be brought to bear on the problem. The new program of landscape architecture within the college will assist in this matter. By means of alliances with other schools at home and abroad, we will offer a course of study and range of ideas that is significantly enriched through first-hand experience and travel. Harry Francis Mallgrave, Director, can be reached at 312.567-3269 or mallgrave@iit.edu. Web: www.icsnc.iit.edu/.

Medical Imaging Research Center (MIRC)

The Medical Imaging Research Center (MIRC) at the Pritzker Institute of Biomedical Science and Engineering promotes, coordinates, and fosters research and educational activities at IIT in medical imaging and related fields. Educational programs include B.S. and Ph.D. programs in Biomedical Engineering and a professional masters degree in Electrical and Computer Engineering. Current projects include: mapping the human brain, new x-ray imgaging techniques, computer-aided diagnosis, and imaging the heart. Miles Wernick, Director, can be reached at 312.567.8818 or wernick@iit.edu. Web: www.iit.edu/mirc/.

National Center for Food Safety and Technology (NCFST)

The National Center for Food Safety and Technology (NCFST) at IIT's Moffett Campus is a unique food research consortium of the U.S. Food and Drug Administration Center for Food Safety and Applied Nutrition, IIT, and the food industry. NCFST's research addresses the food safety implications of emerging technologies in food processing and packaging and supports the development of safe food with health-promoting properties from farm to fork. The facility's extensive laboratory and pilot plant space, including a new biosafety level 3 laboratory and clinical nutrition research center, support research in food microbiology, food processing and packaging, chemical constituents and allergens, and health promoting foods. Educational programs include degree and certificate programs in food safety and technology and food process engineering. Robert Brackett, Vice President and Director, can be reached at 708.563.1577 or rbrackett@iit.edu. Web: www.iit.edu/ncfst

Pritzker Institute of Biomedical Science and Engineering

The Pritzker Institute of Biomedical Science and Engineering is an umbrella organization that enhances the biomedical science and engineering research activities on the IIT campus. The Medical Imaging Research Center (MIRC), the Center for Integrative Neuroscience and Neuroengineering research (CINNR), and the Engineering Center for Diabetes Research and Education (ECDRE), the Center for the Study of Condensed Soft Matter μCOSM, and the Biophysics Collaborative Access Team (BioCAT) are some of the Centers and activities that operate under the Institute. Each of the Centers has a Director and is described in more detail elsewhere in this document. The Pritzker Institute develops and coordinates relationships and programs with traditional science and engineering departments within IIT, as well as outside institutions, especially, Argonne National Laboratory, Rush Presbyterian Medical Center and the University of Chicago. Vincent Turitto, Director, can be reached at 312.567.6927 Web: www.iit.edu/pritzker_institute/.

Thermal Processing Technology Center (TPTC)

Through the Thermal Processing Technology Center (TPTC), faculty and students undertake research to support the needs of the materials processing and manufacturing industries. The center performs high quality basic and applied research in thermal processing technology of interest to the primary metals and manufacturing industry. In addition, the center provides training and education to enhance the human resources available to industry. Multi-disciplinary research teams are used to provide innovative crosscutting technological solutions to industrial materials processing problems. Philip Nash, Director, can be reached at 312.567.3056. Web: http://tptc.iit.edu.

Wanger Institute for Sustainable Energy Research (WISER)

The Wanger Institute for Sustainable Energy Research (WISER) develops close collaborations among numerous programs at IIT with a focus on development of energy-related interprofessional educational and research programs and proposals. The strategy of the institute is to use a least-cost path to improve energy efficiency, enhance power reliability and security, minimize pollution, and continue the decarbonization of the global energy system. IIT researchers believe that the endpoint of this evolution will be electrification of most stationary energy uses with such high-tech renewables as photovoltaic, solar-thermal and wind energy, and the use of hydrogen as the dominant transportation fuel in fuel-cell powered electric vehicles. The institute also has plans to develop research and educational partnerships with the City of Chicago, State of Illinois, industry, national laboratories and other universities. The institute goal is to play a major role in identifying future research directions for shaping national energy policy and sustainability initiatives. Hamid Arastoopour, Director, can be reached at 312.567.3038 or arastoopour@iit.edu. Web: www.iit.edu/wiser/

Wireless Network and Communications Researvh Center (WiNCom)

The Wireless Network and Communications Researvh Center (WiNCom) is an inter-disciplinary research center that will fuse the creative talents of researchers from the Computer Science, and the Electrical and Computer Engineering Departments. The center will focus on state-of-the-art research in the area of wireless communications and networking with a particular emphasis on the challenges of interference in this domain. The immediate goals of the center are (1) to create and maintain a flexible state-of-the-art wireless experimental and simulation based testbed; and (2) to utilize the base understanding obtained through the testbed to support the development of interference mitigation techniques, and to advance emerging wireless technologies, such as cognitive radio and ultrawideband (UWB). Long-term, the center members envision that the center's research and capabilities will attract collaborators from government agencies, industrial organizations, and other universities.

Service, Education, and Outreach Centers

Center for Research and Service

GeneralResearch and Service, Center forThe Center for Research and Service offers professional consulting services through the Institute f Psychology at IIT. The center supports its clients through research-based solutions that improve individual, team and organizational performance. Bruce Fisher, Director, can be reached at 312.567.6471. Web: www.iit.edu/ psyccrs/.

Center for Sustainable Enterprise

GeneralSustainable Enterprise, Center forThe Center for Sustainable Enterprise can bring the many disciplines resident at the Illinois Institute of Technology together in a collaborative relationship with business corporations, other academic institutions, government agencies and members of the NGO community to identify, develop, communicate, and help implement practical and equitable business strategies that advance the ecological sustainability of the Greater Chicago Area, while fostering our current and future economic viability. George P. Nassos, Director, can be reached at 312.906.6543 or george.nassos@iit.edu.
Web: www.stuart.iit.edu/cse/home.html.

Energy/Environment/Economics (E^3)

Energy/Environment/Economics (E^3) is an academic program of research and coursework for students in chemical, mechanical, environmental and electrical engineering. The research program encompasses areas of specialization that relate to energy, sustainable development, industrial ecology and environmental design. Hamid Arastoopour, WISER Director, can be reached at 312.567.3038.

Grainger Power Engineering Laboratory (GPEL)

Grainger Power Engineering Laboratory (GPEL) focuses on studies related to electric power generation transmission, distribution, operation and controls. GPEL houses several graduate and undergraduate laboratories. Annual research support of more than $400,000 is provided by federal and private agencies. S. Mohammad Shahidehpour, Director, can be reached at 312.567.5737.

Institute for Science, Law & Technology

The Institute for Science, Law & Technology provides a forum to produce and disseminate knowledge on the social and legal implications of emerging technologies. As part of its mission, the institute sponsors long-term, multi-disciplinary research, public conferences, judicial training, symposia for journalists, and other programs. Public programming, scholarship and research and student educational opportunities in the Institute focus on biotechnology, genetics, nanotechnology, reproductive technology, diabetes policy, environmental science and intellectual property. In addition, institute staff and faculty draft laws and regulations and develop other programs that guide public policy decisions. Lori Andrews, Director, can be reached at 312.906.5359.

Invention Center

The Invention Center helps students and faculty develop a studio approach to engineering. The center's philosophy is project-oriented, creativity-driven and encompasses all the stages of invention, including idea generation and development. prototype development and proof-of-concept, the patent process and commercialization. Francisco Ruiz, Director, can be reached at 312.567.3212. Web: www.iit.edu/˜invention/.

Manufacturing Productivity Center

The Manufacturing Productivity Center is the hub of all activities relating to manufacturing technology and management. Mazin Safar, Director, can be reached at 312.567.3650. Web: www.intm.iit.edu/cpd/intm/mpc.

Office of Intellectual Property and Technology Transfer

The Office of Intellectual Property and Technology Transfer supports all IIT efforts to build and sustain relationships with corporations and other external organizations. The office coordinates the process of identifying evaluating, protecting, marketing and licensing all IIT inventions and copyrightable material. Robert Anderson, Director, can be reached at 312.567.3462.
Web: www.iit.edu/research/services/ttip/.

Residence and Greek Life

More than half of IIT's full-time undergraduates live on campus. The Office of Residence Life offers a wide range of programs and services designed to enhance campus life. The office coordinates Resident Advisors, Door Guards, and the Residence Hall Association. In addition to seven residence halls, there are six fraternity houses and two sorority houses. Fraternities and sororities have very active program, and membership is open to commuting as well as residential students. Housing for graduate and married students is available in four campus apartment buildings.

Spiritual Life

The Office of Spiritual Life serves students of all faith traditions. Together with student religious organizations and other university offices, the Office of Spritual Life sponsors activities for faith development, worship, socializing, and service. The office sponsors interfaith learning opportunities on campus, and provides information about religious resuorces both on and off campus. Home to IIT's Service Learning program, the office also offers regular community service activities. Lynne Meyer, the Director of Spiritual Life, is available to discuss personal or spiritual issues. Contact the Director at 312.567.3160, or spiritual.life@iit.edu. Web: www.iit.edu/spiritual_life/

Student Activities

Co-curricular activities and events provide opportunities for students to expand their intellectual, social and recreational interests. The McCormick Tribune Campus Center (MTCC) is the site for feature films, comedians and live music. The campus center has lounges, study areas, meeting rooms, student organization offices, an auditorium, a ballroom, a cafeteria, a pub, and a recreation room. The Office of Student Activities oversees many student groups and acts as liaison between the administration and the various organizations. The campus is home to numerous student organizations including the Student Government Association (SGA), Graduate Student Association; the Residence Halls Association (RHA), which governs the hall councils; Greek Council, the governing organization for social fraternities and sororities; the National Society of Black Engineers (NSBE); Latinos Involved in Further Education (LIFE); Union Board, which plans much of the campus social and cultural activities; Technology News, the student newspaper; WIIT-FM, the student radio station; and Commuter Student's Association, the commuter student organization.

Student Affairs

The office of the Dean of Student Affairs oversees many areas of student life and serves as the primary advocate and ombudsperson for students. The office also manages the student conduct process. Students, faculty and staff are encouraged to contact the office for help or referrals. Activities outside the classroom and laboratory complement and enhance IIT's central educational mission. IIT encourages all students to participate in athletics, student organizations and professional societies. Students are also encouraged to take advantage of the cultural, educational and recreational resources on campus, as well as in the Chicago area. For additional information on activities, organizations and services, students should consult the IIT Student Handbook, available at www.iit.edu/student_affairs/.

Student Health Center

Health services are available for all students regardless of insurance coverage. The health service is staffed by master's prepared nurse practitioners who function as advanced practice clinicians in collaboration with a physician. Diagnosis and management of common illnesses and injuries as well as prescriptive authority is within the scope of advance practice nurses. Preventative medicine such as women's health care, immunizations, nutrition and diet information and laboratory testing are available. The health service also provides educational programs throughout the academic year and is available to assist students with wellness or information workshops. A nurse practitioner is available Monday through Friday by appointment and on a walk-in basis in emergency situations. The physician is on site approximately two hours per week. The Student Health Center also serves as the administrator of the student health insurance. The Student Health Center is in IIT Tower Suite 3D9-1; appointments may be made by calling 312.567.7550. Hours are from 9 a.m. to 4 p.m., Monday through Friday.

Technology Commercialization

The Office of Intellectual Property and Technology Transfer, supports all IIT efforts to build and sustain relationships with corporations and other external organizations. The office coordinates the process of identifying, evaluating, protecting, marketing and licensing all IIT inventions and copyrightable material. Assistance with business startup issues is available. Robert Anderson, Director of technology transfer and intellectual property, can be reached at 312.567.3462, or anderson@iit.edu. Dr. Myron Gottlieb, manager of technology transfer and intellectual property, can be reached at 312.567.3596 or gottlieb@iit.edu.

Technology Services

The Office of Technology Services (OTS) supports IIT's primary technology systems including administrative systems, network and telephone infrastructure, and distance learning programs. OTS departments include Technology Infrastructure, Project Management Office, Technology Support, Enterprise Systems, and Telecommunications. The most current information about OTS services is available on the OTS website, http://www.iit.edu/ots

OTS maintains over 500 computers in its classrooms and public terminals throughout Main, Adams Street, and Rice campuses. The classrooms are used for both academic courses and IIT-organized events. The computers in these classrooms are refreshed on a three-year cycle to ensure students have access to equipment that supports their academic goals. The instructional software in the classrooms is reviewed and updated every semester by the IIT Software Committee. OTS supports remote printing from personal computers to printing release stations located in various computer labs and public areas. More information about this service is available on the OTS website, accessible through the myIIT Training and Support tab, and the MyPrint channel, which is located on the Finances tab of the myIIT portal.

The myIIT web portal (http://my.iit.edu) provides personalized access to email, online course registration, Blackboard, OTS Support, student life, and other content. Blackboard, the University's learning management system, hosts a website for every course offered at IIT. The system also serves as a gateway to IIT Online streaming media, which can be accessed by students in both online and live course sections. Instructors post notes, lectures, and assignments on the course page, which also features a discussion board and chat room.

The OTS Support Desk is the central point of contact for technology support at IIT. Support Desk staff provide technical and administrative support for all students, faculty, and staff. Services include troubleshooting, account management, and configuration assistance. The Support Desk website (http://support.iit.edu) houses a knowledge database that is available to all clients and includes how-to and self-help information for common technical issues and questions. Members of the IIT community may submit a request for technical support by opening a ticket through the OTS Support tool on myIIT, via email (supportdesk@iit.edu), or by calling the Support Desk at 312.567.3375 (on-campus ext. 7-DESK).

IIT provides Internet access through its wired and wireless networks. All Main Campus buildings have wired and/or wireless internet access. Visit the OTS web site to view IIT's current WiFi coverage and to learn how to connect to the IIT network.

Visit the OTS website: http://www.iit.edu/ots for the most up-to-date information and useful details about IIT's technology.

Women's Services

The Office of Women's Services serves as the primary office of advocacy for women, offering students and families educational and social programming, aimed at the personal development, retention, and success of all students, both inside and outside of the classroom.

Women's Services include: Women's Cultural Exchange, a program where female students may share cultural information with others; Women in Literary Discussion, where female students explore the world of literature; and the Women's Information Network, a collaborative effort between the Career Management Center, Health Services, International Center, and other campus departments, that provide information, resources, awareness, and support for female students.

Writing Centers

Students can seek assistance with written and oral assignments at two writing centers, both located in Siegal Hall 232. First, the CAC Writing Center supplements instructional material available at the Communication Across the Curriculum website (http://www.cac.iit.edu), and primarily serves students in engineering, sciences, and computer science courses, especially those enrolled in writing-intensive courses (Introduction to the Profession, C-courses, and IPROs). Second, the Humanities Writing Center primarily serves students with assignments in history, literature, philosophy, social sciences, and art and architecture history courses. Its staff are also expert in English as a Second Language, offering special attention to students whose primary language is not English.

Student Counseling Services

IIT Tower, 3rd Floor
http://www.iit.edu/counseling_center/
312.567.5900

Student Counseling Services provides clinical services and outreach programming to IIT students, and consultation to students, staff, faculty, and parents of IIT students. To schedule your first meeting please call 312.567.5900.

Clinical services include brief psychotherapy, referral, and medication management. When a student's treatment needs are best served off campus, counseling services staff will work with the student to find referrals to local service providers. We assist students with many issues, including loneliness, relationship concerns, family issues, self esteem, depression, anxiety, concentration difficulties, sleeping difficulties, eating disorders, addiction, sexual concerns, anger management, cultural adjustment, and other personal issues.

The counseling process aims to help students resolve personal difficulties and acquire the skills, attitudes, and knowledge to take full advantage of their college experience. Length of treatment may vary based on the clinical assessment of treatment needs. We typically offer up to 16 counseling sessions per student. Some presenting concerns are best served by a treatment approach that is not time limited, or require a specialized treatment approach. In those cases, we typically offer referrals to off campus providers.

There is no charge for an initial evaluation. Most of our services, including counseling sessions, are free to currently enrolled IIT students. If there is a charge, notification is made up-front and in writing. Appointments with our psychiatrist and medications may be covered by the student health insurance plan.

Clinical Services are provided by licensed doctorate-level psychologists, a psychiatrist, and closely supervised professionals in training.

Clinical services are confidential. The confidentiality of our services is protected by our professional ethics and by state laws. We typically do not reveal anything about the patient to anyone outside of Student Counseling Services without written permission. There are exceptions to this policy, such as when a therapist believes an individual is a risk of seriously harming him/herself or another person.

Student Counseling Services also provides outreach programs on campus, including workshops, screening days, and presentations. We provide programs on many topics, such as stress management, alcohol and drug abuse prevention, and time management. For a schedule of upcoming workshops visit www.iit.edu/counseling_center.

Student Counseling Services staff frequently provide consultation to members of the university community including staff, faculty, students, and parents who are concerned about a student's welfare. Student Counseling Services can be reached at 312.567.8900, or on the web at www.iit.edu/counseling_center/

Crisis Services

During business hours we provide crisis meetings. If you have an urgent need to speak with someone, please call us at 312.567.5900.

After hours, weekends and holidays there are several options for crisis and emergency situations. All of these options are available 24 hours per day, every day of the week including holidays. Services are available to all IIT students, including those who do not have Aetna health insurance.

Aetna Student Assistance Program crisis line	877.351.7889
National Suicide Prevention Lifeline	800.273.TALK
IIT Public Safety Department	312.808.6363
Chicago Rape Crisis Hotline	888.293.2080
Hazeldon Substance Abuse Recovery	800.257.7810
City of Chicago Emergency	911

Graduate Degree Programs and General Requirements

The university's Armour College of Engineering, College of Architecture, Chicago-Kent College of Law, Institute of Design, Institute of Psychology, School of Applied Technology, and Stuart School of Business award graduate degrees. In many fields, students in master's programs may choose either a thesis track or non-thesis track program. These academic units also work together to offer a wide variety of joint- and dual-degree programs.

Doctoral Degrees

Applied Mathematics
Architecture
Biology
Biomedical Engineering
Chemical Engineering
Chemistry
Civil Engineering
Collegiate Mathematics Education
Computer Engineering
Computer Science
Design
Electrical Engineering
Environmental Engineering
Management Science
Materials Science and Engineering
Mathematics Education
Mechanical and Aerospace Engineering
Molecular Biochemistry and Biophysics
Physics
Psychology
Science Education
Technical Communication

Law Degrees

Juris Doctor (J.D.)
Master of Laws (LL.M.)
Master of Intellectual Property Management and Marketing
J.D./LL.M. in Family Law
J.D./M.B.A. (joint degree)
J.D./M.S. in Environmental Management and Sustainability (joint degree)
J.D./LL.M. in Taxation (joint degree)
J.D./M.S. in Finance (joint degree)
J.D./LL.M. in Financial Services Law (joint degree)
J.D./M.P.A. (joint degree)
J.D./Master of Public Health (joint degree in cooperation with University of Illinois at Chicago)

Master of Science Degrees

Applied Mathematics
Architecture
Biology
Chemical Engineering
Chemistry
Civil Engineering
Computer Engineering
Computer Engineering and Electrical Engineering (dual degree)
Computer Science and Master of Chemical Engineering (dual degree)
Computer Science
Computer Science for Teachers
Electrical Engineering
Environmental Engineering
Environmental Management and Sustainability
Finance
Food Process Engineering
Food Safety and Technology
Information Architecture
Manufacturing Engineering
Marketing Communication
Materials Science and Engineering
Mathematics Education
Mechanical and Aerospace Engineering
Molecular Biochemistry and Biophysics
Personnel and Human Resources Development
Personnel and Human Resources Development (dual-degree w/ B.S. in Psychology)
Physics
Psychology
Rehabilitation Counseling*
Rehabilitation Counseling (dual-degree w/ B.S. in Psychology)*
Science Education
Technical Communication and Information Design

** application to these programs does not require the GRE*

Professional Master's Degrees

These programs are specifically designed with the needs of professionals in mind. Most are course-only and do not require a thesis. In addition, the GRE requirement is waived for applicants to professional master's degree programs who hold a bachelor's degree from an accredited U.S. institution with a cumulative GPA of at least 3.0/4.0.

Architecture (full-time only)
Architectural Engineering
Biological Engineering
Biology
Biomedical Imaging and Signals
Business Administration (M.B.A.)
Business Administration/Master of Design
Business Administration/
M.S. in Environmental Management and Sustainability (dual degree)
Business Administration/ M.S. in Finance (dual degree)
Business Administration/ M.S. in Marketing Communication (dual degree)
Business Administration/ Master of Public Administration (dual degree)
Chemical Engineering
Chemical Engineering and M.S. in Computer Science (dual degree)
Chemistry
Chemistry in Analytical Chemistry
Chemistry in Materials and Chemical Synthesis
Computer Science
Construction Engineering and Management
Design (full time only)
Design Methods
Electrical and Computer Engineering
Electricity Markets
Environmental Engineering
Food Process Engineering
Food Safety and Technology
Geoenvironmental Engineering
Geotechnical Engineering
Health Physics
Industrial Building Delivery
Industrial Technology and Operations
Information Architecture
Information Technology and Management
Integrated Building Delivery
Intellectual Property Management and Markets
Landscape Architecture
Manufacturing Engineering
Materials Science and Engineering
Mathematical Finance
Mathematics Education
Mechanical and Aerospace Engineering
Network Engineering
Power Engineering
Public Administration (M.P.A.)
Public Works
Science Education
Structural Engineering
Telecommunications and Software Engineering
Transportation Engineering
VLSI and Microelectronics

Graduate Certificate Programs

Designed to provide knowledge in a specialized area within an academic discipline, these programs typically consist of 9-12 credit hours of coursework that might otherwise be applicable to a master's degree. Students who successfully complete graduate certificate programs and who subsequently apply for admission and are admitted to a master's degree program at IIT may apply all approved coursework taken in the certificate program and passed with a grade of "B" or better toward the master's degree. Admission to a certificate program does not guarantee future admission to a degree program.

Biological, Chemical, and Physical Sciences
Analytical Method Development
Analytical Spectroscopy
Characterization of Inorganic and Organic Materials
Chromatography
Radiological Physics
Synthesis and Characterization of Inorganic Materials
Synthesis and Characterization of Organic Materials

Chemical and Biological Engineering
Biological Engineering
Current Energy Issues
Food Process Engineering
Food Processing Specialist
Particle Processing
Pharmaceutical Engineering
Polymer Science and Engineering
Process Operations Management

Civil, Architectural and Environmental Engineering
Air Resources
Construction Management
Earthquake and Wind Engineering Design
Geoenvironmental Engineering
Hazardous Waste Management
Indoor Air Quality
Infrastructure Engineering and Management
Transportation Systems Planning
Water and Wastewater Treatment

Computer Science
Computer Networking and Telecommunications
Information Systems
Software Engineering

Electrical and Computer Engineering
Advanced Electronics
Applied Electromagnetics
Communication Systems
Computer Engineering
Control Systems
Electricity Markets
Power Electronics
Power Engineering
Signal Processing
Wireless Communications Engineering

Information Technology and Management
Advanced Software Development
Computer and Network Security Technologies
Data Center Operations and Management
Data Management and Analytics
Digital Voice and Data Communications Technologies
Information Security Management
Information Technology Innovation Leadership and Entrepreneurship
System Administration
Systems Analysis
Web Design and Application Development

Lewis Department of Humanities
Instructional Design
Technical Communication

Mechanical, Materials and Aerospace Engineering
Computer Integrated Design and Manufacturing
Product Quality and Reliability Assurance

National Center for Food Safety and Technology
Food Safety and Technology

Institute of Psychology
Compensation Management
Psychiatric Rehabilitation
Rehabilitation Engineering Technology

Professional Certificates

Chicago-Kent College of Law
Students must be enrolled as J.D. students to earn these certificates:
Criminal Litigation
Environmental and Energy Law
Intellectual Property Law
International and Comparative Law
Labor and Employment Law
Litigation and Alternative Dispute Resolution
Public Interest Law

Stuart School of Business
Business
Business Analytics
Innovation and Emerging Enterprise
Marketing Management
Environmental Management and Sustainability

Finance
Financial Toolbox
Fundamentals of Finance
Corporate Finance (post-graduate)
Entrepreneurial Finance Investments (post-graduate)
Financial Economics (post-graduate)
Financial Modeling (post-graduate)
Investments (post-graduate)
Risk Management (post-graduate)
Trading (post-graduate)

Public Administration
Nonprofit Management
Public Management
Public Safety and Crisis Management

Undergraduate Programs

A complete description of undergraduate programs and admission requirements is available from the Office of Undergraduate Admission at http://www.iit.edu/undergrad_admission/.

Synopsis of Graduate Studies at IIT

The following guideline for prospective and current students shows the steps that must be taken and the forms that must be completed, signed by appropriate university officials, and submitted to the Graduate College Office of Academic Affairs in order to proceed from application to graduation to receipt of degree. The forms indicate which signatures are needed. All forms are available at www.iit.edu/graduate_college/academic_affairs/FormsGradStu.shtml.

	For applicants	**Form or Application Required**
1.	Formal application	Regular application and all supporting materials including official transcripts, letters of recommendation, test scores (if required), professional statement, portfolio (if required) and application fee.
2.	Admission decision	Admission letter from the Office of Graduate Admission outlining terms of admission offer, or informing the student that admission has been denied.
	For admitted and continuing Ph.D. students	
3.	Registration	Registration may be completed online at my.iit.edu under the Academics tab. Continuing students not enrolling for the current term must submit a request for leave or university withdrawal form (see the section on Leave of Absence).
4.	Approval of the program of study	Form G401 must be submitted by the student online at www.iit.edu/graduate_college/ academic_affairs/FormsGradStu.html and will be electronically approved by the faculty adviser and academic unit head/department chair. The form may be revised electronically with advisor approval.
5.	Ph.D. qualifying examination	Department administering exam submits Form G303* (if required).
6.	Ph.D. comprehensive examination	Form G301A. Department submits exam results on Form G309.*
7.	Fulfillment of Ph.D. residency requirement	No form needed.
8.	Appointment of the thesis examining committee/comprehensive examination committee	Form G301A.
9.	Preliminary Ph.D. thesis approval	Form G501A
10.	Final Ph.D. thesis committee approval	Form G301B.
11.	Final thesis defense /oral examination	Department submits exam results on Form G309.*
12.	Thesis fee	Bursar's receipt.
13.	Ph.D. thesis approval signed by the thesis examiner	Form G501B
14.	Completion of courses and other requirements	Listed on the Program of Study or Revise Program of Study that are filed and approved electronically.
15.	Application for Graduation	Application for Graduation Form G527. (Check deadline listed in the Academic Calendar for the semester of desired graduation.)
16.	Fulfillment of all financial obligations to the university	
17.	Commencement (attendance is voluntary)	Registrar announces details in Spring semester (one ceremony per year).
18.	Diploma	Registrar will mail diplomas four to six weeks after semester grades are reported, except spring semester when diplomas are distributed at the commencement ceremeony to participants who have met all degree requirements.

	For admitted and continuing M.S. students	
3.	Registration	Registration may be completed online at my.iit.edu, under the Academics tab. Continuing students who are not enrolling for the current term must file a request for leave or university withdrawal (see the section on Leave of Absence).
4.	Approval of the program of study	Form G401 must be submitted by the student online at www.iit.edu/graduate__college/ academic__affairs/FormsGradStu.html and may be electronically revised with advisor approval.
5.	Preliminary M.S. thesis approval	Form 501A (if required).
6.	Final thesis/ comprehensive examination for M.S. or MAS where applicable	Department submits Form 303. (if required).
7.	Final M.S. Thesis Committee approval	Form 501B (if required).
8.	Thesis fee (if applicable)	Bursar's receipt.
9.	M.S. thesis approval signed by the thesis examiner	Form 501B.
10.	Completion of courses and other requirements	Listed on Form 401 and Form 406.
11.	Listed on Form 401 and Form 406.	Listed on Form 401 and Form 406.
12.	Fulfillment of all financial obligations to the university	
12.	Commencement (attendance is voluntary)	Registrar will mail details in April.
13.	Diploma	Registrar will mail diplomas four to six weeks after semester grades are reported.

Note: Copies of the forms and applications may be obtained from the Graduate College Web Site, www.iit.edu/graduate_college/, or the Office of Academic Affairs, 110 Main Building, 3300 S. Federal St., Chicago, IL 60616 (312.567.3024). A copy of the sequence of events for students who have applied for graduation may also be obtained from the Office of Academic Affairs or at www.iit.edu/graduate_college/.

**Forms 303 and 309, Exam Results Forms, are not given to students.*

Academic units send 303 and 309 forms to the Office of Academic Affairs.

Admission

Application for Admission

Application information and forms for degree and non-degree admission may be accessed by visiting www.iit.edu/graduate_admission/.

All documents submitted in support of an application must be the original or a certified copy. Documents may not be duplicated, transferred, forwarded or returned once they have been submitted to IIT. A non-refundable application/processing fee must accompany the application. Students will find current application fees, applications, and instructions at www.iit.edu/graduate_admission/. Students applying to Stuart School of Business, Chicago-Kent College of Law, and the Institutes of Design, Psychology, and Architecture should visit their respective websites for information. Any applicant or student who has applied to or attended IIT previously is not required to submit an additional application fee.

Students who do not register for the semester they originally applied for must contact the Graduate Admission Office and request to defer their admission for up to one year. Deferral requests may be submitted to gradstu@iit.edu. Transcripts must be submitted for all courses attempted at other institutions that were not listed on previously submitted transcripts. Students wishing to register more than one year after the initial application must apply as a new student and resubmit all documents.

Applications and information for graduate programs in business may be obtained from Stuart School of Business by visiting www.stuart.iit.edu.

Applications for programs in law may be obtained from Chicago-Kent College of Law by visiting www.kentlaw.edu, by calling 312.906.5020, or by writing to the college at 565 W. Adams, Chicago, IL 60661.

Applicatons for the College of Architecture are available by visiting www.iit.edu/arch or by phoning 312.567.3260. The college's mailing address is Crown Hall, 3360 S. State, Chicago, IL 60616.

Degree-Seeking Versus Non-Degree Status

A degree-seeking student is a registered student who submitted an application for admission as a degree-seeking student, was accepted by an academic unit in a specific degree program, and received a formal letter of admission. Degree-seeking students are required to register every semester except summer unless they receive special permission in writing for a leave of absence (Form 216) from the Graduate College, Office of Academic Affairs.

A non-degree student is a registered student who holds an undergraduate degree from an accredited institution, submitted an application for admission as a non-degree student, and was admitted. Non-degree students are those who wish to improve their professional or personal development without being required to fulfill degree requirements, are not certain about their prospective field of study at IIT, have less than a 3.0/4.0 undergraduate GPA, or are unable to submit a completed regular application prior to the beginning of the semester. Non-degree students are not accepted into a graduate degree program and are not classified as degree-seeking students. (See the section on Admission as a Non- Degree Student for procedures on becoming a degree-seeking student.)

Admission as a Degree-Seeking Student

To apply, please submit an application, including all supporting documents and application fee, prior to the published deadlines. Applications received after the specified dates will be considered only if circumstances permit. In addition to the application form, the applicant must submit the following:

1. Official transcripts, or certified copies thereof, of all academic work at the college level or above.
2. Professional Statement
3. Required Test Scores

All applicants are required to submit GRE general test scores. A minimum score of 900 (quantitative + verbal) and 2.5 (analytical writing) is required for M.S./MAS applicants. Ph.D. applicants must meet the minimum requirements of 1000 (quantitative + verbal) and 3.0 (analytical writing). Individual departments, colleges and institutes of IIT may require higher scores. Students should see the specific admissions requirements listed for each academic unit in the relevant sections of this bulletin. GRE scores may be no more than five-years old. The IIT code number is 1318. The GRE requirement is waived for applicants to professional master's degree programs who hold bachelor's degrees from an accredited degree program at a U.S. college or university with a cumulative GPA of 3.0/4.0 or higher. The required minimum cumulative undergraduate GPA for regular admission is 3.0/4.0. Students with a 2.5/4.0 GPA may be admitted as non-degree students with probationary status. (See Admission as a Non-Degree Student.)
Applicants to Chicago-Kent College of Law must submit LSAT scores and other documentation as required by the law school. Stuart School of Business applicants are required to submit GMAT or GRE, and other documentation as required by the business school. Prospective students can obtain more information about admission requirements for Chicago-Kent College of Law at http://www.kentlaw.edu/ and for Stuart School of Business at http://www.stuart.iit.edu/.

Meeting the minimum required test scores and GPA does not guarantee admission. Specific requirements and factors considered by academic units in admission decisions for specific degree programs are outlined in the relevant sections of this bulletin.

Admission as a Certificate Student

Admission as a certificate student requires that the student submit the online application form and official transcripts of all college-level coursework. A certificate student must possess a bachelor's degree with a cumulative GPA of 2.5/4.0. A certificate student whose bachelor's degree(s) is not in the field of certificate study or a closely related field may be required to take additional prerequisite courses that may not count toward the certificate. Certificate students are permitted to enroll in as many credit hours as are necessary to complete the certificate.

Certificate students who later apply and are admitted to a master's degree program may apply only approved certificate coursework with a grade of B or better to the master's degree.

Admission as a Non-Degree Student

Citizens and permanent residents of the United States may apply as a non-degree student under the following classifications:

Applicants with Incomplete applications, who have a minimum undergraduate GPA of 2.5/4.0, or who cannot submit required documentation by the application deadline, or who are undecided on their long-term status or degree program. A final admission decision (degree-seeking admission) may be deferred until the requisite GPA has been achieved in study as a non-degree student, or until the required documents are submitted. Non-degree students seeking to convert to degree-seeking status must complete a regular online application to a degree program prior to the completion of nine credit hours of study. If a non-degree student applies for and is granted admission to a degree program, a maximum of nine credit hours of approved coursework taken as non-degree student and passed with a grade of B or better may be applied to the degree.

Applicants that must complete specific pre-requisite courses prior to consideration of admission to a degree-seeking program. Courses taken in this classification are not counted toward degree requirements.

Applicants that do not intend to acquire a graduate degree in any specific discipline and wish to enroll in a variety of courses. Students may not pursue or earn a graduate certificate or degree while admitted in this status. Course credits earned are for continuing professional education.

The Office of Graduate Admission will notify non-degree students of the conditions under which they are admitted. Students should also refer to the section on transfer credit.

International students on an F-1 visa cannot be admitted as non-degree students in any classification.

Inernational Applicant Requirements

General Requirements

International applications are incomplete until the following are received:

1. Application fee.
2. TOEFL scores (if required).
3. GRE scores.
4. Official transcripts of all academic work at the university level or above.
5. Professional statement and portfolio (if required).
6. Two letters of recommendation (three for Ph.D. applicants).

If any of these documents are not in English, the student must provide a certified English translation by a qualified translator, together with the original certified non- English credentials. A minimum score of 900 (quantitative + verbal) and 2.5 (analytical writing) is required for M.S./MAS applicants.

Ph.D. applicants must meet the minimum GRE requirements of 1000 (quantitative + verbal) and 3.0 (analytical writing). Individual departments, colleges, and institutes of IIT may require higher scores. Students should see the specific admissions requirements listed for each academic unit in the relevant sections of this bulletin. GRE scores may be no more than five-years old.

English Competency

Non-native English speakers must prove proficiency in English by submitting a TOEFL or IELTS score. The total TOEFL score requirement is 90 with minimum section scores of 20 (internet-based). The total IELTS score requirement is 6.5 with minimum section scores of 5.5. TOEFL section scores of less than 20 or IELTS section scores of 6.0 5.5, on any section will place you into the corresponding IIT English course: ENGL 051 Listening Comprehension, ENGL 052 Reading Comprehension, and ENGL 053 The Research Paper. You are required to take the first of any such necessary courses during your first regular semester at IIT. Applicants with four or more years of undergraduate education in English as the medium of instruction will be exempt for the TOEFL and any English courses.

By accepting admission to the university, you are also agreeing to take any additional English courses the Graduate College deems necessary. Recognizing that paying for additional courses will be a financial hardship for many students, the Graduate College offers a discount of 50% off the regular graduate tuition for the first English course a student must take. If a student must take a second English course, the tuition discount for the second course will be 25%. Should a student be required to take a third English course, there would be no tuition discount for the third course.

Students whose TOEFL or IELTS section scores indicate they must take two or three English courses will have the opportunity to take an IIT exam near the end of their first course to determine whether their English has improved enough to exempt them from the additional course(s). This exam will be given only to enrolled members in the English courses.

All students may retake the TOEFL or IELTS exam at any time before or during their studies at IIT. If the scores on the new exam are higher than on the previous exam, we will use the new scores to determine placement in English courses. Students are responsible for making arrangements to retake the TOEFL or IELTS and having the official scores from Educational Testing Service or IELTS International submitted to IIT.

Applicants should have the official test results sent from appropriate testing agency to the Office of Graduate Admission, Illinois Institute of Technology, 10 W. 33rd St., Room 203, Chicago, IL 60616. The IIT school code number is 1318.

Please Note: Students who scored poorly on the speaking section of the TOEFL or IELTS are strongly recommended to take an optional eight week Pronunciation Seminar offered by the Professional Learning Programs. For information please contact internationalinfo@iit.edu or 312-567-5280.

Financial Support

IIT funds available to assist international students are limited and are usually awarded to a small number of selected students with outstanding academic credentials. Applicants on F-1 student visas are not eligible for part-time employment during their first year at IIT. International students must provide a certified financial affidavit from a responsible government official, or an official of a recognized financial institution, certifying that the student has (or will have available) funds to cover their entire period of study at IIT, and that the funds are free from restrictions and immediately available to cover a period equivalent to one calendar year. The I-20 or DS-2019 cannot be issued until an acceptable affidavit of financial support is received. Additional funds will be needed for travel expenses. Simple statements from parents or relatives to pay all expenses are not acceptable. Bank statements are not acceptable unless accompanied by a certified statement that the funds may be transferred to the United States for the student's use. Documents must be dated within 6 months of the student's beginning date.

All credentials for international students should be received by the published deadlines. Completion of applications after that date may not allow time for a decision to be made and/or a visa to be issued for the semester requested. It is also helpful for applicants to submit a copy of their passport with their application materials, to verify accuracy of the applicant's name. Applicants are warned not to make definite arrangements for attending IIT until they have received a formal notice of admission. Students will be advised of their admission or denial as soon as possible after IIT's receipt of all credentials, usually within six weeks, unless additional information is required.

Readmission for a Second Graduate Degree

A student who earns a graduate degree at IIT is not automatically accepted as a student in a second-degree program in either the same or a different academic unit. Continuation for a second degree is contingent upon admission in the second program. Additional information is available from the Office of Graduate Admission.

Newly Admitted Students

Accompanying the admission letter will be a website link to the Intent to Enroll form, housing information, initial registration instructions, medical examination form, and an immunization form. For international students the admission packet will include the I-20 or DS-2019 and a link to the Graduate Student Handbook. To register in the semester for which they were admitted, students must return the completed medical form and immunization form.

Arrangements for campus housing must be made directly with the Director of Housing, Illinois Institute of Technology, 3303 S. State St., Chicago, IL 60616 (phone: 312.567.5075) or email housing1@iit.edu. Admission does not include commitments for room and board. A cash deposit is required with the application for housing. In general, IIT cannot provide housing assistance for students who wish to live off campus.

Newly admitted students should consult their academic units concerning program, degree requirements and special departmental regulations, and should make every effort to arrive at IIT in time for the initial registration advising date. If students cannot arrive before the last day of late registration, the Office of Graduate Admission must be notified at gradstu@iit.edu.

Enrollment Confirmation and Deferral Requests

At the time of admission, the student should submit a non-binding Intent to Enroll Form at http:// gradenrol.iit.edu/joiniit/joiniit.htm, or send an email to joinus@iit.edu, to reserve a place in the program. All students who wish to defer their enrollment to the subsequent semester must request the deferment by contacting the Graduate Admission Office (gradstu@iit.edu, 312.567.3020.). International students may be required to submit a new bank statement.

Immunization Requirement

In accordance with Illinois law, all students born on or after January 1, 1957, and enrolling at IIT for the first time after July 1, 1989, must supply health provider-documented evidence of vaccination for diphtheria, tetanus, measles, rubella, and mumps. Transfer students are considered as first-time enrolled students. Students enrolling for the first time during a summer session may be permitted to enroll in the subsequent fall semester before providing proof of immunity. Students who wish to enroll only in one class per semester or via IITV at corporate sites may file a written request for an exemption. Exemption from one or more of the specific requirements may also be granted based on documented medical or religious reasons. A student who fails to provide acceptable evidence of immunity shall be prevented from registering for classes in the next semester. Individuals who are not properly immunized or who do not have proof of immunization may receive the required immunizations at the Student Health Center for a nominal fee. The Certification of Immunization form is available at http://www.iit.edu/˜shc/forms/ImmunizationReq.pdf. Questions regarding this policy should be directed to the Student Health Center, Illinois Institute of Technology, IIT Tower, Suite 3D9-1, 10 W. 35th St., Chicago, IL 60616, 312.808.7100 or student.health@iit.edu.

Post-Baccalaureate (UPB) Students

Applicants with bachelor's degrees who are ineligible for graduate admission may be admitted as undergraduate post-baccalaureate (UPB). In general, UPB admission may be offered to domestic applicants who are required to complete a number of prerequisite courses to improve their undergraduate performance or complete prerequisites for graduate study. These students may later be considered for admission as non-degree graduate students at IIT. Students should apply for Undergraduate Admission-UPB status through the Office of Undergraduate Admission, by visiting www.iit.edu/undergrad_admission/applu.

Registration

Full-Time Versus Part-Time Status

Full-time students are regular, matriculated students that meet any of the following criteria:

(a) Register for a minimum of nine credits per semester (six credits in summer).

(b) Hold university-approved fellowships, or teaching or research assistantships, regardless of the number of credits of registration. Additional restrictions may apply to International students enrolled for less than six hours. Consult the International Center.

(c) Are occupied with an academic activity that mandates an equivalent of full-time study, regardless of the number of credits of registration. (This privilege may be used in a limited number of occasions and requires the written consent of the faculty advisor and the endorsement of the Graduate College, Office of Academic Affairs.)

Note: Full-time international students must fall into categories (a) or (b). International students enrolling less than full-time in the semester of graduation or falling into category (c) must file a petition (less than full-time eligibility) in the International Center by registration deadline. In order for the nine hours of registration to be considered full-time, only one course may be audited. International students may only take one online course per term, to count towards their full-time enrollment. The maximum study load for regular students is 15 credit hours per semester except by permission of the Graduate College's Office of Academic Affairs. During the summer session, the normal study load is six credit hours.

Part-time students are those who do not fulfill any of the above criteria for full-time students.

Who Should Register

Any graduate student who is using university facilities and/or faculty time must register for a minimum of one credit in fall, spring and summer semesters. A student must be registered:

1. During the semester of qualifying and comprehensive examinations.
2. During the semester of final thesis defense.
3. During the semester in which the degree is awarded.

A graduate student who receives any type of stipend must meet the minimum registration requirements for the fall and spring semesters. Occasionally, students may need to complete an internship or thesis or dissertation fieldwork away from the university as part of their academic program; those students may petition to be considered full time while conducting field research or completing an internship if they previously satisfied the university residency requirements. The full-time equivalent for such students is one semester credit. The petition must be endorsed by the student's advisor and academic unit head, and forwarded to the Graduate College, Office of Academic Affairs for approval.

Course Numbering

Course numbers 100–399 are primarily used for undergraduate courses. Courses 400–499 may be used for minor credit or as prerequisites when taken as part of an approved graduate program (see department requirements: a maximum of 12 credit hours of 400 level classes may be included). Courses numbered 500–799 are graduate level and are primarily for graduate students; the grade earned by graduate students must be a "C" or better.

Course Descriptions

Course descriptions are available in the Academic Programs section of this bulletin and online at my.iit.edu, under the Academics tab

Registration for Fall and Spring Semesters

Specific procedures and regulations for registration are found each semester in the Enrollment Guide or at my.iit.edu, under the Academics tab. The schedule for the spring semester is available the second week of November, and schedules for the summer session and the fall semester are available the second week of April. Students who were admitted to, but did not attend, IIT must be readmitted by the Office of Graduate Admission before they can register. Continuing students may register for classes through regular registration procedures online, in the myIIT portal. All graduate students registering for research courses numbered 591, 594, 597, and 691 must receive written or online approval from their faculty advisor before registration. These registrations may be completed through web registration if an online permit is submitted by the course advisor/instructor.

Newly admitted and continuing students may register in advance in November (for spring) or April (for summer or fall) of each year. Students may also register in August (for fall), January (for spring) or in May and June (for summer). Registration confirmations are sent via email within 24 hours of completing registration. For questions concerning registration procedures, students should contact the Student Services Center at 312.567.3100 or at student.services@iit.edu.

Registration for T.A. Seminar

All new teaching assistants are required to register for a zero-credit hour T.A. Seminar (department's course number 601) given every fall semester.

Registration for Continuation of Residence

Degree-seeking students in the final semester are allowed to register for one semester of non-credit, or a continuation of residence (course number 600), for a fee equivalent to one credit hour.

IPRO Registration

Graduate students may serve as project leaders on an Interprofessional Project (IPRO). A student who wishes to do so must first consult his or her academic advisor and the project advisor. With the approval of both, the student should register for IPRO 597.

Change of Registration After Initial Registration

The term "change of registration" means adding a course (a "course" includes courses, projects or research courses/ hours); dropping a course; shifting from one section to another in the same course; or changing the number of credits in a variable-credit course (e.g., research hours). A course may not be added or changed to another section after the first week of course instruction.

The Change of Registration may be completed in the myIIT portal in Banner Self Service. Students requiring assistance may contact the Office of the Registrar, registrar@iit.edu, or visit the Student Services Center, 104 Main Building, 3300 S. Federal St., Chicago, IL 60616. A course may be dropped during the first two weeks of the regular semester for refund or credit, and during the first week of the summer semester. A course may be withdrawn with no refund or credit between the third and the tenth week of the semester. No courses may be withdrawn after the withdrawal deadline; extenuating circumstances must be petitioned for review in the Graduate College, Office of Academic Affairs. No registration change or withdrawal is official until the form is approved by the Registrar's Office. Notifying the instructor or merely discontinuing course attendance is not sufficient for withdrawal. The date of the withdrawal form will be the official date of withdrawal. All billing inquiries related to registration changes may be referred to the Student Services Center. International students are required to remain full-time, i.e. carry nine credit hours of study and may not change their registration to become part-time except in the semester of graduation. (Students should refer to the note under "Who Should Register".)

Withdrawal from the University

Students who wish to withdraw should first consult their academic advisor. The advisor may be able to suggest resources or alternate solutions to the student's problems. International students wishing to withdraw are required to consult the foreign student advisor in the International Center as well. For withdrawal, regular graduate students must complete the electronic withdrawal form online in the myIIT portal by selecting the option from the Academic Affairs Channel. Withdrawal from IIT is not complete until an official email is received by the student confirming its completion.

Undergraduates Registering for Graduate Courses

An undergraduate degree-seeking student who wishes to enroll in a graduate 500-level course must first obtain written approval from the course instructor and faculty advisor stating that the student is qualified. Undergraduate students registering for more than nine credit hours of graduate courses must also obtain written approval from the Graduate College, Office of Academic Affairs. This approval must be presented at the time of registration. An undergraduate non-degree student may be permitted to enroll in a graduate 500 level course in certain instances, but will require the permission of the Office of Educational Services and the Graduate College, Office of Academic Affairs. All undergraduate students who enroll in graduate courses are governed by the graduate grading system for those courses. Failure to obtain the appropriate approvals may prevent transfer of credits earned into graduate degree programs at IIT. No credits approved toward the undergraduate-degree requirements will transfer into any graduate program at IIT. Students should consult the rules for transfer of credit under "Transfer Credits".

Academic Policies for Continuation of Studies

Leave of Absence

Degree-seeking students who intend to leave IIT for one semester or more must complete the online leave of absence form in the myIIT portal by selecting the option from the Academic Affairs Channel. A leave of absence will not be granted for more than one year, at which time, a request for an extension of leave may be submitted. A leave of absence will not extend the time limit required for the completion of a degree. A leave will not be approved after the sixth week of the current semester. Students who have not renewed their leaves of absence and have not registered for courses as of the end of their respective leaves must petition for reinstatement to the Graduate College, Office of Academic Affairs. Degree-seeking students who do not plan to return to the program should submit the Withdrawal Form. Non-degree students are not required to file a Leave of Absence Form, but will require reinstatement by petition on form G701, after a lapse in registration. Students should consult the procedures for filing a petition under the section "Right of Appeal by Petition".

Note: International students must also receive approval from the International Center. If an international student wishes not to enroll in a given term, the leave of absence must be approved by the International Center, by the registration deadline of that term.

Reinstatement and Enrollment After an Absence

Degree-seeking graduate students who discontinue their studies without an official request for leave of absence may later be refused reinstatement or enrollment at IIT. Students with an unofficial interruption of studies must petition for reinstatement to the Graduate College, Office of Academic Affairs. Students should contact the Graduate College, Office of Academic Affairs for additional information. Procedures for filing a petition may be found within the "General Policies" section of this bulletin.

Grade Point Average

Satisfactory performance in the graduate divisions is defined as the maintenance of a minimum cumulative GPA of 3.0/4.0, as reported by the registrar. The minimum GPA for graduation is 3.0/4.0. This figure is based only on those courses that appear on the approved program of study and not on the total cumulative GPA reported by the registrar; there is no exception or waiver to this rule. If a student repeats a course, the last grade issued for the course will be used to compute the cumulative GPA and the program of study GPA. Students should consult the section on repeating a course within this bulletin.

Academic Probation

A student whose cumulative GPA falls below 3.0/4.0 is no longer in good standing and must petition the Graduate College, Office of Academic Affairs for permission for provisional enrollment by submitting form G702. Students for whom provisional enrollment is granted must not earn a semester GPA less than 3.0 while on Academic Probation. Probationary students who receive "C" or "E" grades will be required to repeat courses, subject to the limits specified within this bulletin, to improve the cumulative GPA. Dismissal will occur when a student fails to make the requisite academic progress during the probationary period. Students may not register for Co-op while on academic probation. If a student's GPA in his or her approved program of study is below 3.0, then graduate courses approved on a revised Program of Study Form G406 may be added to the program until the corresponding GPA is at least 3.0, with the approval of the Graduate College, Office of Academic Affairs.

Credit Requirements

Unless otherwise specified, all master's degree candidates must complete a minimum of 30 credits beyond the bachelor's degree at IIT. Consult this bulletin on the total credit hour requirements for each degree. A maximum of nine semester hours, earned with "A" or "B" grades, may be transferred from other accredited institutions.

Ph.D. candidates must complete a minimum of 84 credits beyond the bachelor's degree.

Each Ph.D. student must include the equivalent of at least one year of full-time work devoted to research. In general, this requirement is fulfilled by registering for a minimum of 24 credit hours of research. However, some departments require a more extensive research experience. The upper limit is 48 credit hours for research. The remaining credit hours required for the Ph.D. degree, a minimum of 36, are satisfied by registration in and completion of courses deemed pertinent to the Ph.D. program by the students advisory committee and by the Graduate College, Office of Academic Affairs.

Transfer Credits

For master's degree programs, a maximum of nine semester hours taken elsewhere and not applied toward any earned degree, which were passed with grades of "B" or better, may be transferred, subject to the approval of the academic unit and the Graduate College, Office of Academic Affairs. Students who have completed their baccalaureate degree at IIT with course credits in excess of the number of hours required for that degree, which were not applied toward the baccalaureate degree, may also be allowed to transfer up to nine of those excess hours. Course credits in excess of the nine credit hours may be used for a degree program provided the credits were not applied toward a prior degree and the student has received the permission of the advisor, the academic unit head, and the Graduate College, Office of Academic Affairs prior to registering for any of the additional courses. Doctoral degree candidates may transfer previously completed graduate work not applied toward any prior earned degree, up to a maximum of 42 semester hours of credit beyond the baccalaureate degree (which may include up to 32 credits from a completed master's degree), or 50 percent of their total IIT Ph.D. program credit hour requirements, whichever is smaller. The work must be judged to be relevant to the current doctoral program, must have been completed with grades of "B" or better, and must be acceptable for graduate credit at the institution where taken. The master's degree must have been granted within the previous six years. Grades for transferred credits will not be included in the student's GPA at IIT.

Transferring from Another Program

A regular student planning to transfer from one degree program to another should discuss the matter with academic advisors in both programs. The student should then submit an application for admission to the new department in the Office of Graduate Admission. The student will be notified once the decision is made.

Program of Study

A graduate degree will be awarded upon the completion of a coherent program of study. Form G401 is the mechanism for outlining and obtaining approval of a coherent program and may be accessed and submitted online at www.iit.edu/graduate_college/academic_affairs/FormsGradStu.shtml. Master's and doctoral students must file a program before completing nine credits of graduate study. However, doctoral students without a prior master's degree may file a program of study before completing 27 credit hours. After these deadlines, further registration may not be allowed until a program of study is approved by the Graduate College, Office of Academic Affairs. A graduate student will be assigned to a preliminary advisor when admitted as a regular student. An academic advisor will be officially assigned before the student's program of study is approved. The student may subsequently change advisors by filing the Change of Advisor Form, G410, online at www.iit.edu/graduate_college/academic_affairs/FormsGradStu.html.

Course Substitution

Once a student has filed a program of study, deviation from the program requires the same formal approval on a Revised Program of Study Form, G406, as the original plan of study. The Graduate College, Office of Academic Affairs may not approve changes in the program after the student has filed an application for graduation without the approval from both the academic advisor and the department chairman. Once a course on the program has been completed (i.e., grades have been issued), it may not be dropped to raise the program GPA required for graduation. The Revised Program of Study Form G406 can be accessed and submitted online at www.iit.edu/graduate_college/academic_affairs/FormsGradStu.shtml.

Credit by Examination

With the prior approval of their respective advisors, academic unit heads and the Graduate College, Office of Academic Affairs, students may obtain credit for a course by paying a $100 per credit hour fee and taking a special examination. Credit by examination is limited to nine credits with grades of "A" or "B" and is subject to the limitations for transfer credit in a degree program. Special exams are not permitted for courses in which the student has previously enrolled or for topics in which the student has never taken a course. Students need to be registered in a semester in which a special examination is taken.

Academic Grades

The following grades are given to graduate students and count in calculating a student's cumulative GPA. GPA is calculated by dividing the total number of grade points earned by the total number of graded semester or quarter hours. Courses not taken at IIT are not included in computing the GPA. Students may access their grades online at my.iit.edu, under the Academics tab.

Grade	Grade Points per Credit Hour	Description
A	4	Excellent.
B	3	Performance at the level necessary for a graduate degree.
C	2	Performance below the overall level necessary for a graduate degree. Some academic units require students to repeat certain courses if the initial grade was a "C.'
D	1	Passing. Used for undergraduate students and in the Stuart School's master's degree programs
E	0	Unsatisfactory performance. This grade cannot be used to fulfill a graduate program requirement. If required in a program of study, the course must be repeated.
AU	N.A.*	Audit. No credit is given for an audited course and it is not used to calculate a student's GPA.
WP	N.A.*	Withdraw passing.
I	N.A.*	Incomplete.
NG	N.A.*	No grade due to non-attendance
WE	0	Withdraw failing.
S/U	N.A.*	Satisfactory or Unsatisfactory.
R	N.A.*	Research result pending

Incomplete ("I") Grades

The "I" grade indicates that the student's work to date is of passing quality but is incomplete for reasons acceptable to the instructor. The grade of "I" may be assigned only in the case of illness or for unusual or unforeseeable circumstances that were not encountered by other students in the class and that prevent the student from completing the course requirements by the end of the semester. "I" grades should not be used to allow a student to repeat a course. Prior to assignment of the "I" grade, the student and the instructor should agree on the work that needs to be completed. The work must be completed by no later than the end of the sixth week of class of the next regular (fall or spring) semester.

A grade of "I" will be removed with the approval of the department chair and the Graduate College, Office of Academic Affairs after all remaining work is completed and the instructor assigns a regular grade. If no regular grade has been received in the Office of Student Records and Registration by the deadline, the "I" grade will revert to a grade of "E." No exceptions will be granted except through appeal to the Graduate College, Office of Academic Affairs.

In the case of research courses, courses numbered 591 and 691, the grade of "R" may be assigned for the reasons listed above and will remain until the student has satisfactoraly completed the course work. Once assigned, the grade of "R" will remain on the student's transcript until the research as determined by the research professor is completed. "R" grades should be removed as soon as possible and no later than the start of the semester in which the student plans to graduate.

Non-Attendance "NG" Grade

A grade of NG is assigned by the course instructor when a student registers but does not attend a course in which he officially registered. A course must be dropped by the deadline for drop/add as published in the semester Academic Calendar to avoid financial penalty. The NG grade is not calculated in the GPA; however, the student forfeits the course tuition.

Withdraw Passing ("WP") and Withdraw Failing ("WE") Grades

Withdraw passing ("WP") and withdraw failing ("WE") are grades issued to students who withdraw from a class after the term has begun. Neither "WP" or "WE" can be changed to a legitimate letter grade.

Satisfactory ("S") and Unsatisfactory ("U") Grades

Satisfactory ("S") and unsatisfactory ("U") grades are only used for the following courses: 591 (Research and Thesis), 594 (Project and Report), 691 (Research and Thesis), noncredit courses and individual courses specifically approved to receive such grades. A student who receives a "U" in course numbers 591, 594, or 691 must demonstrate to his or her advisor, academic unit head and the Graduate College, Office of Academic Affairs why he or she should be allowed to continue as a graduate student. Students registered for course number 597 are not eligible for "S/U" grades. "S/U" grades are not used in calculating the GPA.

Audit ("AU")

In general, grades of "E", "I", "U", "WE", "WP", "NG", or "AU" cannot be used to fulfill the requirements of a graduate program. Auditing of courses is discouraged, but a student may do so if he or she has taken the necessary prerequisites, if the student's presence does not exclude a student who wishes to enroll for credit and if the student's presence does not distract from the conduct of the course as determined by the instructor. An auditor must pay full tuition for the course but is not held for examinations and does not receive credit. Auditors may not change their registration to receive credit after the deadline posted in the Enrollment Guide. The "AU" grade issued for an audited course can never be changed, used for graduate credit, or for fulfillment of degree requirements at IIT.

Change of Grade

Once grades are posted by the registrar or instructor, grade changes can only be accomplished by a Change of Grade Form. The student's instructor must indicate the requested change, and give a reason as to why the change should be approved by the academic unit head. The approved form should be forwarded to the Graduate College, Office of Academic Affairs which will either reject the request and return the form to the academic unit, or approve the change and send the form to the registrar. No grade change is official until it is posted on the student's transcript by the registrar. Research ("R") grades in thesis, project or special problem courses numbered 591, 594 and 691 remain on the student's record until changed by the instructor. A student receiving an incomplete in any other course must arrange with the instructor to change the grade before the end of the sixth week of the semester following the term in which the incomplete was granted. An incomplete will revert to an "E" and cannot be changed to a passing grade at a later date, unless approved by the course instructor, the academic unit head and Graduate College, Office of Academic Affairs.

Repeating a Course

Students may repeat up to two distinct courses with each course being repeated once. Both grades will be recorded and the grade used in the calculation of the GPA will be the latest recorded. Re-registration to repeat a course will require the permission of the student's advisor, academic unit head, and the associate dean for academic affairs, and will also require completion of the "Course Repeat/Audit Form." This form must be submitted at the time of registration and can be accessed online at www.iit.edu/registrar/registration_tools/pdfs/grad_course_repeat.pdf. The original course grade earned will remain on the student's academic transcript.

Residence Requirement

Degree-seeking graduate students are required to register every fall and spring semester unless they receive special permission in writing from the Graduate College, Office of Academic Affairs for a leave of absence. In addition, doctoral students must spend a minimum of one year of full-time study at IIT. (Students should consult the definitions of a full-time student and credit requirements listed within this bulletin). That year must occur within six years prior to awarding the degree. Some academic units have academic residence requirements for master's degrees as well.

Time Limit to Complete a Degree

All requirements for a master's degree must be completed within the 12 semesters immediately preceding graduation. All requirements for a doctoral degree must be completed within 12 regular semesters after the approval of the program of study. If the twelve-semester deadline is not met, then a petition for extension must be filed by the student and the outdated courses listed on the student's program of study (Form G401) must be revalidated. The petition must include a detailed plan for the completion of the degree and be endorsed by the academic advisor and the academic unit head. The student's petition for extension must be presented before the time limit is reached. The Graduate College, Office of Academic Affairs will notify the student of their decision and any additional requirements that must be met. In no case will an approved extension of time eliminate the need for revalidation of outdated courses for a graduate degree at IIT. A statement from the academic unit head indicating the list of courses on the student's program of study that are to be revalidated (Form G504) and the expected date for the revalidation must accompany the extension approval. The M.S. or Ph.D. comprehensive or thesis examination may serve the purpose of revalidating the outdated program of study.

Class Attendance

All students are expected to attend their courses regularly. Excessive absences may cause a student to be dropped from the course at the discretion of the instructor, academic unit head and the Graduate College, Office of Academic Affairs. A dropped student receives a grade of "WP" or "WE" in the particular course. In the case of illness or other emergencies that require a student to be absent for more than two days of courses, the dean of student affairs should be notified at the earliest possible date. In case of an emergency on campus, students should contact the Public Safety Department at 312.808.6300.

Master's and Doctoral Examinations

Master's Comprehensive Examination

The master's comprehensive examination is used to determine whether the student has acquired the knowledge commensurate with the courses shown in the student's program of study. The examination may be oral, or written, or both. The academic unit determines the form, scope, and time of the examination. The master's thesis examination may serve as the comprehensive examination. The academic unit has the option of offering professional master's degrees with a minimum of 30 credit hours without requiring a comprehensive exam (i.e. coursework only). In the case of an oral examination, at least two Category I (tenure track) faculty members must be present to serve in the student's committee at the examination. One external, non-IIT or other faculty categories at IIT, committee member with voting privilege may be included with the approval of the Dean of the Graduate College. With the approval of the academic unit chair, the student's advisor must recommend the external member to the Dean of the Graduate College. A resume should be attached to the recommendation. Other faculty and external visitors may attend. The result of the examination must be approved by a majority of the committee. The committee's decision must be submitted to the Graduate College on Form G303 at least 15 days prior to the end of the semester. The graduate student must be registered in the semester in which the examination is given. A student who fails the comprehensive examination may repeat the examination once after a period of at least 30 days from the initial examination. Any additional consideration must be petitioned, supported by the academic unit, and approved in writing by the Graduate College, Office of Academic Affairs.

Master's Thesis Examination

Once the preliminary draft of a master's thesis is prepared, the head of the student's academic unit will appoint a master's thesis committee, consisting of at least two or more Category I (tenure track) IIT faculty members. One external, non-IIT or other faculty categories at IIT, committee member with voting privilege may be included with the approval of the Dean of the Graduate College. With the approval of the academic unit chair, the student's advisor must recommend the external member to the Dean of the Graduate College. A resume should be attached to the recommendation. The thesis committee is responsible for approving the preliminary thesis draft using Form G501A, which the student brings to the thesis examiner prior to the final oral examination. The form, scope, and time of the examination are determined by the academic unit. The examination result must be submitted on Form G303 at least 15 days prior to the last day of courses. The graduate student must be registered in the semester in which the examination is taken. A student who fails the thesis examination may repeat the examination once after a period of at least 30 days from the initial examination. Any additional consideration must be petitioned, supported by the academic unit and approved in writing by the Graduate College, Office of Academic Affairs.

Doctoral Examinations

Qualifying Examination

A qualifying examination is required for all doctoral students. The composition of the qualifying examination committee is determined by the academic unit. The voting members of the committee should be Category I faculty. One external, non-IIT or other faculty categories at IIT, committee member with voting privilege may be included with the approval of the Dean of the Graduate College. With the approval of the academic unit chair, the student's advisor must recommend the external member to the Dean of the Graduate College. A resume should be attached to the recommendation. The exam may be given along with the master's comprehensive examination. Students must be registered in the semester in which the qualifying examination is administered. The following rules apply to the qualifying examination:

1. The qualifying examination may be written and/or oral, and cover major and minor subjects.
2. If the academic unit requires a written exam, the student's committee is responsible for submitting the questions and for conducting the exam. The committee may conduct an oral portion of the qualifying examination. A minimum of four Category I (tenure track) faculty members must participate in the oral portion of the examination.
3. The examination must be taken within the first year of Ph.D. study if the student has an M.S. degree.
4. All work for a doctoral degree must be completed within six calendar years after the approval of the program
5. The results of the qualifying examination must be submitted within fifteen days of the administration of the examination on Form G303 to the Graduate College, Office of Academic Affairs.
6. If the student fails the qualifying examination, the examining committee may recommend a re-examination. At least one semester of additional preparation is considered essential before re-examination. The second chance for taking the qualifying exam is regarded as final. Any additional considerations must be petitioned, supported in writing by the academic unit and approved in writing by the Graduate College, Office of Academic Affairs.

Comprehensive Examination

After the approval of a program of study and within a period of time specified by the academic unit, the student must appear for the comprehensive examination. Though students typically take this examination at the end of the second year of Ph.D. study, the only time requirement is that the comprehensive examination is completed at least one year prior to the final thesis examination. The student must be registered in the semester in which the examination is taken. The proposal for Ph.D. dissertation is normally presented as part of the comprehensive examination. The following rules apply to the comprehensive examination:

1. The examination may be written, oral, or both.
2. A minimum of four Category I (tenure track) faculty are required for all examining committees of doctoral candidates. The chair and two other members from the committee must be from the student's major, and the fourth member must be from outside the student's major (e.g., MAE faculty may serve on an MSE student committee). One external, non- IIT or other faculty categories at IIT, committee member with voting privilege may be included with the approval of the Dean of the Graduate College. With the approval of the academic unit chair, the student's advisor must recommend the external member to the Dean of the Graduate College. A resume should be attached to the recommendation. The graduate dean is an ex-officio member of all examining committees. To substitute for the chair of the committee, the new chair must be a Category I (tenure track) faculty member in the same academic unit. The role of the outside member of the committee is to provide an element in the examining committee function that is independent of the immediate interest of the academic unit in which the candidate is seeking his or her degree. The outside member of the committee has the responsibility of representing the interest and function of the Graduate College and the university in a context distinct from that of the degree-granting academic unit. Faculty holding joint or adjunct appointments in the degree-granting academic unit or non-faculty coadvisors cannot be outside members on a student's committee. They may, however, serve as the additional members of the committee.
3. The committee is nominated by the academic unit head and appointed by the Graduate College, Office of Academic Affairs. The nominations must be received on Form G301A by the end of the second week of the semester in which the examination is going to be held. The Graduate College must be notified on Form G301A of the time and date of the comprehensive examination at least two weeks before the examination.
4. Any faculty member may attend oral comprehensive examinations, but only the appointed Category I and external committee members may vote. Passing the examination requires one vote more than a majority of the official committee. Dissenting members may bring a split decision before the graduate dean for adjudication.
5. If part of the examination is failed, the report should note which part is to be repeated in a second examination. A student who fails the comprehensive examination may be re-examined after a period of 30 days has elapsed. Students failing the examination twice will be asked to terminate their graduate study at IIT. In extenuating circumstances the academic unit head may show cause why a third examination should be given. A re-examination after two failures requires the approval of the Graduate College, Office of Academic Affairs. Failure of the third examination will result in termination without recourse.

Final Thesis Examination

The final thesis examination may be scheduled at least one year after the comprehensive examination. The following rules apply to the final thesis examination:

1. The eligibility for the membership of the final thesis examination is the same as that listed earlier for the comprehensive examination. The examining committee must consist of at least four Category I (tenure track) faculty members who must sign Form G301B. One external, non-IIT or other faculty categories at IIT, committee member with voting privilege may be included with the approval of the Dean of the Graduate College. With the approval of the academic unit chair, the student's advisor must recommend the external member to the Dean of the Graduate College. A resume should be attached to the recommendation. Faculty members holding the rank of research professor or associate professor may be appointed as non-voting co-chairs of the final thesis examination committee. An emeritus professor who has a current research professor appointment and who has been active in guiding and supporting the student may be co-chairs and voting members of the student's committee. The examining committee is nominated by the academic unit head and appointed by the Graduate College, Office of Academic Affairs by the second week of the semester in which the examination will be administered.
2. At least five weeks prior to commencement, the preliminary draft of the thesis must be approved on Form G501A by the committee and by the thesis examiner before the student's appearance for the oral examination. The oral examination will be canceled if the preliminary draft is not acceptable before the scheduled time for the oral examination.
3. Form G501A is to be signed by committee members as they receive the draft of the final copy of the dissertation prior to the defense and for review. The approval of Form G501A indicates that faculty members have received a copy of the dissertation and are willing to read and comment on it. The members of the committee are not allowed to share the content of the draft with any outside individuals without the permission of the committee chair. After the first submission of the dissertation, the thesis examiner checks Form G501A for signatures of committee members, and the academic unit head. The thesis examiner also checks the format, paper stock and pagination, and reviews portions of the text for general usage, references and bibliographic form.
4. Upon final submission, the signature pages and the final thesis approval form (Form G501B) are checked by the thesis examiner for signatures of committee members, academic unit head and the Graduate College, Office of Academic Affairs. The signatures on Form G501B indicate that the committee members are satisfied with the content of the dissertation and no additional changes are required before its final submission to the Graduate College's Editorial Office. It is the responsibility of the student and the committee chair to notify the Graduate College of any changes in the structure of the examining committee. The same committee that approved the preliminary dissertation must also approve the final copy of the dissertation.
5. The examination is open to all faculty but only the appointed committee members may vote. The chair of the committee is responsible for the conduct of the examination. In addition, Form G301B must be received by the Graduate College, Office of Academic Affairs by the end of the second week of the semester in which the examination is going to be held. The Graduate College must be notified of the date and time of the final thesis examination at least two weeks before the examination using Form G301B. Examination results reported on Form 309 must be received in the Graduate College at least 15 days before commencement. Three copies of the completed dissertation must be deposited with the thesis examiner at least nine days before commencement.
6. A student who fails the thesis examination may be re-examined after a period of 30 days has elapsed. Students failing the examination twice will be asked to terminate their graduate study at IIT. In extenuating circumstances the academic unit head may show cause why a third examination should be given. A re-examination after two failures requires the approval of the Graduate College, Office of Academic Affairs. Failure of the third examination will result in termination without recourse.

Qualifying, comprehensive, and final examinations for graduate students are to be held on the IIT Main Campus. Exceptions to this policy are made only for certain graduate students whose examinations are administered at other IIT campuses.

Completion of Studies and Graduation

As part of the requirements for the completion of graduate studies at IIT, each student must be admitted as a regular student, file and complete a program of study approved by the corresponding degree program officials and the Graduate College, Office of Academic Affairs. Ph.D. students must also pass the qualifying and comprehensive examinations, fulfill the residence requirement and submit a dissertation before graduation. (Students should refer to the "Synopsis of Graduate Studies" portion of this bulletin for a list of steps and corresponding forms that must be completed, the detailed degree requirements listed under the relevant academic unit in this bulletin, and the information regarding program changes, for additional information).

Completion of Degree

Master's Degree Candidates

The starting date for any course applied toward the degree must be no earlier than six years before the graduation date. If this condition cannot be met, the student may petition the Graduate College, Office of Academic Affairs for an extension. Any courses that fall outside the six-year time limit must be revalidated.

Doctoral Degree Candidates

Doctoral study must be completed within six years of the date of approval of the program of study. An extension will require an agreed upon schedule for the completion of remaining degree requirements. Any courses that fall outside the six-year limit must be revalidated.

Application for Graduation

Students expecting to graduate in a given semester must file an Application for Graduation (Form G527) in the Graduate College, Office of Academic Affairs, by the deadline listed in the Academic Calendar for the semester of graduation. Late applications will be declined. Final revisions to the program of study must be filed by the graduation application deadline. Students' names may be deleted from the graduation list upon request, but no new names will be added after the late deadline. Upon submission of a graduation application, the Graduate College, Office of Academic Affairs will check for completion of IIT's degree requirements. The diploma will be issued by the registrar after grades are reported, usually about four to six weeks after the end of the term. Students who participate in the annual graduation commencement ceremony in spring semester will receive the diploma for their earned degree at the ceremony. Students should not file the Application for Graduation form unless they are reasonably sure that they can complete the degree requirements in time to meet the deadlines. An application for graduation is good for only one semester. If the student fails to graduate in the intended semester, a new application must be filed for a later semester. The fee is only paid once, however.

Professional Master's Degree

A professional master's degree is offered to graduate students who seek the non-thesis option. As used here, a thesis is a written document or manuscript that concerns an investigation or discourse. A professional master's degree program may require a project and a project report (e.g., Course 594); however, neither the project itself nor the project report is considered a thesis. Storage of project reports will be at the discretion of academic units and cannot be done in the IIT library. Registration for thesis research cannot fulfill a requirement for a non–thesis degree.

Change of Master's Thesis to Non-Thesis Option

In several majors, a master's degree may be earned without the preparation of a thesis. When changing from a thesis to non-thesis option, a student may transfer up to four hours of credit for satisfactorily completed Course 591 (Research and Thesis for the Master's Degree) to satisfy the requirement for Course 594 (Special Projects), provided that two conditions are met: first, the student's GPA must be at least 3.0/4.0; second, the student's academic unit must permit the change to a non-thesis option after consulting with the student's adviser and must approve the transfer on the grounds that the thesis-oriented work is equivalent to work on a project.

Procedures for evaluating the transfer of credits from 591 and 691 to 594 (and for evaluating the student's performance on the Special Project) must be documented and monitored by each academic unit. The graduate college will allow up to 4 credits of 591 or 691 to be converted to 594 credits.

To initiate a request to change from thesis to a non-thesis option, the student will complete a G403 Change of Degree, Major, or Specialization Form at www.iit.edu/graduate_college/academic_affairs/FormsGradStu.html.

Certificate Programs

A graduate certificate program (GCP) is defined as a group of three to five 400- and 500-level courses in a concentration within a department or program organized with the objective of training students in a specific area of expertise. Admission to a GCP is limited to students who qualify as non-degree graduate students who hold a bachelor's degree with a GPA of 2.5/4.0 or higher. The GRE is not required. Admission as a certificate student does not guarantee future admission to a graduate degree program.

Course requirements for a GCP are determined by the individual department, and must have a minimum of nine credit hours with at least one course at the 500 level. No more than nine credit hours of 400-level courses can be included; no more than half the credits or courses may be specialized (topical) accelerated courses. Transfer credit cannot be applied toward a graduate certificate.

The time limit for its completion is three years. A student may complete more than one graduate certificate.

A GPA of 3.0/4.0 or greater is required in the certificate courses before a graduate certificate can be awarded. Form G528 Application for a Graduate Certificate must be filed by certificate students delineating the courses completed for a particular graduate certificate. This form is available from Graduate College, Office of Academic Affairs, and must be approved by that office and by the academic unit head.

The completion of a GCP will be indicated on the student's transcript. A certificate student who subsequently applies to and is admitted to a specific master's degree program may apply all approved coursework taken as a certificate student and passed with a "B" grade or better to the master's degree program.

Graduate Accelerated Courses

An accelerated course (formerly known as a short course) is a graduate-level course offered in a two-week (14-day) or shorter duration of time, and satisfies the lecture contact-time standard of fifteen 50-minute class sessions per semester credit hour, excluding final exam time. These are topical courses that should be no more than three credit hours. A new accelerated course is subject to the normal departmental review as for a regular new graduate course. Approval is required by the department curriculum committee, the academic unit head and the Graduate College, Office of Academic Affairs.

No more than six credit hours of accelerated courses may be included in a master's degree program of study. Accelerated courses can be selectively included in a Ph.D. program of study at the rate of six credits per 32 course credits, and their inclusion is subject to approval of the adviser, academic unit head and the Graduate College, Office of Academic Affairs .

Students must register for the accelerated course before the first class session in order to receive credit for the course.

Thesis Preparation Meeting

A mandatory thesis preparation discussion is held at the beginning of every semester to assist graduate students with the preparation of their theses. The exact date and time is emailed to all graduation applicants by the Graduate College, Office of Academic Affairs at 312.567.3024. All students who are required to submit a thesis for graduation must attend this meeting, which is open to all students, faculty and staff. Graduate student theses must conform to the guidelines given in the latest IIT Thesis Manual, available online at www.iit.edu/graduate_college/ academic_affairs/Thesis_information.shtml.

Appointment with Thesis Examiner

All students submitting a thesis must make an appointment with the thesis examiner for the approval of the preliminary draft of their theses. The meeting with the thesis examiner must be scheduled at least six weeks before the end of the semester and prior to the thesis defense. At least five weeks before the end of the semester of graduation, all students submitting a thesis must make a second appointment with the thesis examiner for the approval of the final draft.

The second meeting with the thesis examiner must take place after the thesis defense and the approval of the final draft by the thesis review committee.

Letter of Completion

A student who has completed all the requirements for graduation may request a letter of completion from the graduate dean at any time during the semester. The student will not receive his or her diploma until grades are reported by the registrar, usually within five weeks after the end of the semester or term.

Transcript of Grades

Transcripts of grades are issued from the Office of the Registrar, 104 Main Building. Visit www.iit.edu/registrar/student_records/transcripts.shtml for information regarding this process. Requests for transcripts should be made at least 10 days prior to the date the transcript is needed and should include the student's Social Security or ID number, dates of attendance and address where the transcript should be sent. During registration week, please allow additional time for processing transcripts. Transcripts will be released only after the student has fulfilled all financial obligations to the university. Students may view their transcripts online and may complete a transcript request form at www.iit.edu/registrar/. A fee of $10 is charged for each transcript issued.

General Policies

Regulations Subject to Change

Regulations and policy guidelines are established by the Graduate Studies Committee, composed of the graduate dean and an elected representative from each graduate degree program on the Main Campus. Every attempt is made to keep this bulletin up to date; students, however, should consult the Graduate College, Office of Academic Affairs or the academic unit head for revisions and updates. The latest version of the Graduate Bulletin is maintained on the Graduate College's Web site at www.iit.edu/graduate_college/bulletin/.

Right of Appeal by Petition

A student should attempt first to resolve any departure from the stated rules with his or her advisor and academic unit head whenever possible. Questions regarding theses must be referred to the thesis examiner. If necessary, the student may submit a written petition signed by the academic advisor and the academic unit head to the Graduate College, Office of Academic Affairs explaining any extenuating circumstances and requesting a specific solution (waiver) with appropriate additional requirements that may develop. The written approval must be attached to Form G701, Graduate Student Petition. Form G701 will not be accepted without a prior approval of the academic advisor and the academic unit head, unless the conflict is unresolved between the student and the advisor or the academic unit head. The graduate dean's decision regarding the unresolved conflicts is final.

Change of Records Information

Students must promptly advise the Graduate College, Registrar, and their respective academic units if they change their name, Social Security Number, mailing address or telephone number. Students may update their local, work, next-of-kin and e-mail addresses online at www.iit.edu/registrar go to Student Records Update/Personal Information. Any changes requested for name, permanent address or student identification number must be done in writing. Change of Information Forms are available at www.iit.edu/registrar/student_records/pdfs/iit_personal_information_request.pdf

Standards of Conduct

Students are responsible for their own conduct; university regulations and requirements are published in the Student Handbook. Graduate students are subject to the rules and regulations published in this handbook. IIT reserves the right to terminate a student's enrollment or to deny enrollment when it is judged to be in the best interest of the student or the university. The Student Handbook is available online at www.iit.edu/student_affairs/handbook.

Code of Academic Honesty

Illinois Institute of Technology expects students to maintain high standards of academic integrity. Students preparing for the practice of a profession are expected to conform to a code of integrity and ethical standards commensurate with the high expectations that society places upon the practitioners of a learned profession. No student may seek to gain an unfair advantage over another. It shall be a violation of this code for students to engage in conduct that violates the standards of their major academic discipline, the standards of the academic discipline in which they are engaged, the standards of a profession in which they are training, or the standards of the university set forth here. It is a violation for a matriculated or nonmatriculated student, whether or not currently enrolled in the university, to knowingly engage or attempt to engage in:

1. Misrepresenting any work submitted for credit as the product of a student's sole independent effort, such as using the ideas of others without attribution and other forms of plagiarism.
2. The use of sources beyond those authorized by the instructor in any work submitted for credit.
3. The use of any unauthorized assistance in taking quizzes, tests or examinations.
4. The acquisition, without permission, of tests, answer sheets, problem solutions or other academic material before such material is revealed or distributed by the instructor.
5. Failure to abide by the instructions of an instructor or exam-proctor.
6. Hindering any member of the IIT community in his or her studies, research, or academic work.
7. Making material misrepresentation in any submission to or through any office of the university to a potential employer, professional society, meeting, or organization.
8. Knowingly making false accusation concerning academic honesty or giving false information to any authority investigating a violation of this code.

Note: Students in the Chicago-Kent College of Law are subject to the Chicago-Kent College of Law Code of Conduct.

Expenses and Financial Assistance

All University mandatory and non-mandatory charges are published regularly in official University publications including electronic mail and web site postings. For a complete listing of current tuition, fees, and other charges go to www.iit.edu/registrar/finance/, then select Tuition and Fees. The University regrets that continually rising costs do not permit it to guarantee that published charges will not change. Students and parents should anticipate periodic increases in the future.

Admission Application Fee

All first time applications for graduate admission must be accompanied by a non-refundable fee. Any applicant who has attended IIT previously, or who has already paid an application fee to IIT, does not have to pay a second application fee. Please contact the appropriate program admissions office for any applicable fee.

Graduate Tuition

Graduate level enrollments are generally charged at a per credit hour tuition rate. This rate applies to all courses for which a graduate student registers whether at the graduate or undergraduate level.

Some programs particularly at Chicago-Kent School of Law and at Stuart School of Business charge different rates depending on the program. Consult the official University publications including electronic mail and web site postings for the latest charges.

No charge is made for seminars carrying no credit hours. For review or other noncredit courses, tuition is computed by considering the number of class meetings per week as equivalent to the number of credit hours.

Graduate students registered for nine (9) credit hours or more are considered full time. Graduate students registered for less than nine (9) credit hours are considered part time.

Enrollment Deposit

Each student admitted as a full-time degree-seeking graduate student to certain programs is required to make a non-refundable enrollment deposit, which is credited toward the student's cost of attendance and holds a place in class for the initial semester of enrollment.

Orientation Fee

First time graduate students are charged a one time fee to cover the costs of orientation activities for their first term of enrollment.

Other Fees & Charges

A student may incur other fees and charges that are both mandatory and non-mandatory. For a complete current listing of all charges and fees go to www.iit.edu/registrar/finance, then select Tuition and Fees.

Books and Supplies

Books and supplies are available at the University bookstores. Costs for books and supplies can differ significantly depending upon the field of study. Students in the College of Architecture may spend less on books but substantially more on supplies

Payment of Tuition, Room and Board, and Other Fees and Charges

Payment of all term charges to the University is due on the first day of classes of each term. For those unable to complete payment by that deadline there are several payment plan options available that incur additional plan fees. The latest information and costs and payment plan enrollment forms are at www.iit.edu/registrar/, select Student Records. Failure to adhere to any payment plan schedule of payments will result in late fees in addition to any plan administrative fee.

Payments may be made by cash, check, money order, or credit card. Credit card payments may be made at my.iit.edu, select IIT Web for Students, select Student & Credit Card Payment. Payment may also be made in person at the IIT Cashier's Office in the Main Building, Main Campus or at the Bursar's Office at the Downtown Campus. Payment by mail may be made by contacting the Bursar's Office at bursar@iit.edu; or at my.iit.edu, select "My Accounts" channel within the Finances tab. The current mailing address and contact information regarding any questions about bills and payments.

Outstanding Debts

A restrictive hold is placed on a student's record when that student is delinquent in fulfilling his or her financial obligation to the University. A student will be considered delinquent when his or her account is not current according to established University policies and payment due dates. Students with outstanding University debts may be suspended from current term classes. Students whose accounts are not current will not be allowed to register or attend classes for any subsequent term. No diploma, certificates of attendance, letters of completion, or transcripts of academic records will be issued until all financial obligations have been met.

University Refund Policy

Under exceptional circumstances, such as withdrawal for involuntary military service, serious illness or injury, or action by the university, consideration may be given by the University for a refund or credit for unused tuition upon written request to the applicable program administrative office. Payments for other charges incurred may be the responsibility of the student at the determination of the University.

Students should consult www.iit.edu/bursar/tuition/ for the approved University refund schedule.

Student Health Insurance

All students who are either registered for 9 or more credit hours or occupants of IIT residence halls are required to purchase the basic student health insurance policy or to submit proof of equivalent insurance before the end of the first week of classes. All students who are here on an F1 or J1 visa and are registered for at least 1 class, participants in the co-op program, research or teaching assistants or occupants of IIT residence halls are required to purchase the basic student health insurance. The premium for the basic insurance will be added to student tuition and fees as a charge. To avoid this charge, submit proof of comparable coverage online at www.iit.edu/student_health/insurance/. F1 and J1 students may only waive IIT's coverage with proof U.S. employer provided insurance. Once a waiver is accepted it will be valid through the student's continued enrollment at IIT. Other students, spouses, and dependents of students may participate in the student health program, if desired. Students should consult the Student Health Service in Farr Hall, at 312.808.7100, for further details.

Parking Fee

All students parking in campus parking lots must register their cars with IIT Parking Services and pay a parking fee at the beginning of the semester. For current fees, students should contact Parking Services at www.parking.iit.edu or 312-567-8968. Students authorized to park in IIT lots will receive a parking hangtag.

Housing

The university offers two types of Housing: Residence Halls (furnished dormitories) for undergraduates and single graduate students and Graduate Apartments - unfurnished apartments for married and single graduate students.

Applications are processed in the order in which they are received and will only be processed if the application is accompanied with the appropriate non-refundable deposit (accepted in the form of an international money order, personal check or Visa, Discover or Master Card credit card.)

It is not to be assumed that sending an application with a deposit, or a fax, or an e-mail will guarantee a space. Only students who have actually received a room assignment confirmation will be guaranteed housing.

If the student arrives without a housing confirmation, he/she may have to contact Hostelling International to make arrangements for temporary housing while waiting for room to become available.

Residence Halls

Although residence hall rooms are furnished with twinsize beds, desks, desk chairs, dressers, etc., students are required to provide their own blankets, pillows, towels, and bed linens.

McCormick Student Village (MSV)

Traditional dormitory style residence halls of approximately 20 rooms per floor share a centrally located common washroom facility. The average room is 10'9" x 15'9" and is double occupancy. Single occupancy rooms are not guaranteed.

MSV Room Rates for the 09-10 academic year range from $5,176 to $7,962. MSV Board Rates for the 09-10 academic year range from $4,528 for a 14-meal plan to $4,764 for an unlimitedn meal plan.

Participation in the university food program is required. MSV contracts do not cover winter break or summer housing. Students who wish to reside over the winter break and/or summer may apply for this option at an additional cost. See contract for details.

State Street Village (SSV)

State Street Village, a new, state-of-the-art residence complex, offers two types of furnished living arrangements - quad suites and apartments. The apartments are equipped with refrigerators, ranges and microwaves. Residents in quad suites are required to purchase meal plans. Participation in the university food program is optional for the SSV apartment residents.

SSV Room Rates for the 09-10 academic year range from $7,841 to $12,864. SSV Board Rates for the 09-10 academic year range from $4,528 for a 14-meal plan to $4,764 for an unlimited meal plan.

The SSV Academic contract rates include housing over the winter break. Summer housing option is available at an additional cost.

* These rates are subject to change. Please visit http://www.housing.iit.edu for current rates, deadlines and other housing information.

Apartment Housing (Family Housing) - For Graduate Students or Families

University apartments are completely unfurnished, except for a refrigerator, range and window coverings. All units have wireless internet, but any air-conditioning, cable tv, phone service, furniture, linens, etc. must be supplied by the tenant. Heat, gas, and electricity are included.

Apartments range in size from a studio (no bedroom) up to three-bedroom units. Monthly rent for a standard 12-month lease ranges from $783 to $1,393.

Prospective tenants must complete an apartment application and pay a non-refundable $50.00 application fee. Units are offered according to date of application. Once an offer is accepted, a reservation fee of $225 is due. This fee will go towards the security deposit and will be forfeited if you fail to move into the apartment reserved for you. Upon move-in, the balance of the security deposit (equivalent to 1 month's rent) and the first month's rent is required.

Graduate students looking for roommates are encouraged to post their information of the Housing web site at http://www.housing.iit.edu. Keep in mind that roommates must be affiliated with the university and approved by Housing.

Housing is not guaranteed. Units are offered on the basis of availability.

Temporary Off-Campus Housing

Temporary off-campus housing may be available at Hostelling International, 24 East Congress Parkway, three miles north of the university. Contact them at 312.360.0300 or www.hichicago.org for information.

The student must have a signed housing contract with IIT in order to stay in university housing. If he/she arrives on campus without a room confirmation, housing is not guaranteed. Contact Hostelling International if a place to stay is needed while the housing process is completed.

Financial Aid

Student Eligibility Requirements to Receive Federal Financial Assistance

Students must be U.S. citizens or eligible non-citizens and be enrolled in a degree-seeking program for at least half-time (five credit-hours or more per semester).

Comprehensive Financial Aid Program

IIT administers a comprehensive financial aid program, which includes federal and private funds for both full and part-time students. Federal programs include loans and work-study employment. IIT uses the formula established by the U.S. Congress to determine financial need for assistance. IIT offers limited academic scholarship assistance to graduate students. Private loans are also available and are based on credit approval from the lender.

For the most up-to-date information, visit the office of Financial Aid online at www.iit.edu/financial_aid/.

Determining Financial Need for Assistance

Financial need is the difference between a student's total annual cost of attending IIT and the amount the student is expected to contribute toward the cost of attendance. The total cost of attendance at IIT includes tuition and mandatory fees, room and board, books and supplies, transportation and personal expenses. The amount that the student is expected to contribute is called the Expected Family Contribution (EFC) and is calculated by a formula determined by the U.S. Congress. After the EFC is subtracted from the cost of attendance, the remainder is considered to be demonstrated need for financial assistance. One of the principles of need-based assistance is that students are expected to help pay some of the cost of attendance.

Application Process

All students applying for financial assistance need to complete the Free Application for Federal Student Aid (FAFSA). This application is available after January 1st at www.fafsa.ed.gov and should be filed by the student as soon as possible after January 1st of the academic year in which the student is planning to enroll. (The IIT School Code is 001691). The priority date for campus-based federal aid (Federal Perkins Loan and Federal Work Study) at IIT is April 15th. All financial assistance is awarded on an annual basis. Students interested in receiving federal aid must complete a FAFSA each year, beginning January 1st. The amount of financial aid that a student receives each year depends on demonstrated need and the availability of funds. Students applying for financial aid may be required to submit tax information upon request.

Federal Financial Aid Programs

Federal Work Study Program

Federal Work Study provides opportunities for students to work on or off-campus. Both undergraduate and graduate students with demonstrated financial need may be eligible to participate in this program. Students awarded work study funds can earn money to help pay educational expenses. On campus jobs are advertised at www.cmc.iit.edu. Off-campus jobs will be private, non-profit organizations or public agencies that encourage community service work. Off-campus jobs are also advertised by the Career Management Center. This office assists students in finding summer employment and permanent jobs after graduation.

Students awarded work study are paid at least the current federal minimum wage or higher, depending on the type of work performed. Students are paid hourly and receive a biweekly paycheck. Work study students may not work more than 20 hours per week during the academic year. Students apply for work study by filing the FAFSA.

Federal Direct Loan Program

The Federal Direct Loan Program includes the Stafford Subsidized and Unsubsidized loan programs for undergraduate and graduate students. The Stafford Loan Program provides low-interest loans to assist students with paying educational costs. The interest rate for new loans is set on July 1 and is fixed. These loans must be repaid over a period of time after a student leaves school.

The Subsidized Stafford Loan is awarded based on demonstrated financial need, and students do not pay interest on the principal while in school. The Unsubsidized Stafford Loan is not awarded based on demonstrated need; and, interest is charged from the time that the loan funds are disbursed to the student. Students have the option of paying the interest or having the interest added onto the principal. Fees of up to 4 percent are charged on each loan, and are deducted before the funds are applied to the student's account.

Continued Eligibility for Financial Assistance

All students receiving federal financial aid funds must demonstrate reasonable academic progress toward graduation from IIT. Reasonable academic progress includes satisfactory cumulative grade point average and sufficient credit hours earned each semester toward the completion of a degree program. Failure to comply with IIT's Reasonable Academic Progress Policy will lead to the student's losing eligibility for federal financial assistance.

Applying for a Financial Assistantship

A fellowship provides financial support to defray the cost of tuition and a stipend for living expenses. A tuition scholarship (TS) provides all or part of the tuition only. Both are exempt from federal income taxes. Most degree programs provide financial support for teaching assistants (TA) who help with instruction, and research assistants (RA) who work on funded research projects. Graduate assistants (GA) receive partial support in the form of a stipend with no tuition support.

Only full-time students are eligible for assistantships. New students will be considered for fellowships, assistantships and scholarships when they apply for admission and will be notified of the award with the admission decision or shortly thereafter. Continuing students should apply to their major academic unit. The Graduate College administers a number of fellowships and scholarships but does not directly administer assistantships available to students in each academic unit. Acceptance of an award or appointment for the fall semester is considered binding on the student after April 15. If a student's academic work is judged to be unsatisfactory, the award may be canceled at the discretion of the university at anytime during the period covered.

Although an outstanding international student may receive some kind of award from IIT, most students must provide independent finances for their first year of graduate study. International students who are not recommended for an assistantship that would cover both tuition and stipend are required to carry at least nine credit hours per semester in order to maintain their F-1 student visa status.

Please Note: The tuition scholarship, plus any loan eligibility cannot exceed attendance cost for the academic year. Previously awarded looans may be adjusted after tuition scholarship notification.

Additional Information

All financial aid awards for graduate students (excluding law and business students) are processed by the IIT Office of Financial Aid. Students should submit all information regarding financial assistance to: Office of Financial Aid, 3300 South Federal Street, Chicago, IL 60616 (telephone 312.567.7219). The office is open from 8:30 am to 5pm, Monday through Friday, and may be found online at www.iit.edu/financial_aid/.

Alumni Tuition Benefit (ALUMED)

Alumni registering as part-time undergraduate students are permitted to register for one course offered by IIT each semester at a cost of one-half the current tuition rate. Alumni registering as part-time or full-time graduate students will receive a one-third reduction of the tuition charges for one course. Alumni that are eligible for the Dean's Scholarship and the ALUMED benefit may combine both forms of funding. Alumni who are awarded a research or teaching assistantship are not eligible for the ALUMED benefit.

Alumni registering as new students in a Chicago-Kent degree program are not eligible. This benefit does not apply to short courses, special programs, research, thesis, and non-credit courses. Tuition discounts may not be applied retroactively.

Dean's Scholarship for Full-time Alumni

Provides a half-tuition scholarship (maximum 9 credits total) during the first year of graduate studies at IIT. Available to any student who graduated from IIT within the past 2 years with an undergraduate GPA of at least 3.5 out of 4.0, enrolling in a full-time graduate program in Armour College of Engineering, the College of Architecture, the College of Science and Letters, the School of Applied Technology, or the Institute of Psychology. This scholarship does not apply to IIT alumni pursuing a second or additional graduate degree.

Part-Time Employment

Part-time employment opportunities may be available for students, both on- and off-campus. Positions include Federal Work Study jobs, career related co-ops and internships, or part-time and seasonal work. Co-ops, internships, and on-campus jobs are posted in the Career Management Center (CMC) e-Recruiting database. Other on-campus jobs may be announced directly by individual university departments. Students interested in and eligible for employment off-campus in their field of study can get job search assistance from the CMC and must attend an Introduction to Cooperative Education and Internship workshop conducted by the CMC. Workshop schedules are posted at www.cmc.iit.edu. Appointments for individual career counseling may be made by calling 312.567.6800.

International students (on F1 visa) are restricted to on-campus employment for their first academic year of study at any school in the United States. After completing one academic year in the United States, students on F1 visa may be eligible for employment opportunities off-campus through the Cooperative Education or Internship Programs.

Veterans' Educational Benefits

Veterans enrolling for the first time should obtain Veterans Affairs application forms from the Office of Student Records and Registration, Room 104, Main Building 312.567.6742. The university's Veterans Affairs representative processes subsequent enrollment certifications. For further information on veterans benefits, or to request an application, please visit www.iit.edu/registrar/. The veteran must also inform the Veterans Affairs representative of any change in credit hours within a term or of future enrollment plans. If a veteran drops a course or withdraws from school completely, his or her allotment may be reduced or withdrawn. The veteran must report immediately the exact termination date to the Veterans Affairs representative. Veterans must maintain reasonable academic progress according to university standards. Failure to meet minimum-progress criteria can result in a cessation of educational benefits.

Academic Programs

Department of Applied Mathematics

School of Applied Technology

College of Architecture

Department of Biological, Chemical and Physical Sciences

Department of Biomedical Engineering

Department of Chemical and Biological Engineering

Chicago-Kent College of Law

Department of Civil, Architectural and Environmental Engineering

Department of Computer Science

Institute of Design

Department of Electrical and Computer Engineering

Energy/Environment/Economics

Food Safety and Technology

Industrial Technology and Management

Information Technology and Management

Intellectual Property Management and Markets

Department of Mathematics and Science Education

Department of Mechanical, Materials and Aerospace Engineering

Institute of Psychology

Stuart School of Business

Technical Communication (Lewis Department of Humanities)

Department of Applied Mathematics

208 Engineering 1 Building
10 W. 32nd St.
Chicago, IL 60616
312.567.8980
312.567.3135 fax
www.math.iit.edu

Chair:
Fred J. Hickernell

Director, Graduate Studies:
Xiaofan Li

The Department of Applied Mathematics puts mathematics to work solving problems in science, engineering and society. Applied mathematicians investigate a wide variety of topics, such as how to construct methods for multi-criteria decision making (requiring discrete mathematics and statistics), predicting how financial markets will behave (requiring probability/statistics, analysis and optimization), and understanding how liquids flow around solids (requiring computational methods and analysis). Our programs focus on four areas of modern applied mathematics: applied analysis, computational mathematics, discrete applied mathematics, and stochastics. More detailed descriptions of these areas follow.

Degrees Offered

Master of Science in Applied Mathematics
Doctor of Philosophy in Applied Mathematics
Master of Mathematical Finance (collaborative program with the Stuart School of Business)
Doctor of Philosophy in Collegiate Mathematics Education (joint program with the Department of Mathematics and Science Education)

Research Facilities

The department provides students with office space equipped with computers and full access to the universitys computer and library resources. The department also has a 128-core computer cluster for research purposes.

Research and Program Areas

The research and teaching foci of the Department of Applied Mathematics at IIT are primarily in four areas of modern applied mathematics: applied analysis, computational mathematics, discrete applied mathematics, and stochastics. These areas are briefly described in the following subsections; faculty with primary and secondary interests.

Applied Analysis

Applied analysis is one of the foundations for interdisciplinary applied mathematics. The principles of (functional) analysis are applied to such areas as partial differential equations, dynamical systems and numerical analysis.

The basic framework, concepts and techniques of modern mathematical analysis are essential for modeling, analysis and simulation of complicated phenomena in engineering and science. Applying the ideas and methods of modern mathematical analysis to such problems has been a thoroughly interdisciplinary effort.

Research and teaching within the applied analysis group at IIT concentrates on development and application of new techniques for investigating numerous phenomena in engineering and science. In particular, members of the group do research in nonlinear dynamics, approximation theory, numerical analysis, fluid dynamics, materials science, viscoelastic and polymeric fluid flows, biological science, quantum mechanics and electro-dynamics, solid mechanics, financial engineering and other disciplines.

Primary interests: Bielecki, Duan, Edelstein, Lubin

Secondary interests: Cialenco, Fasshauer, S. Li, X. Li, Nair, Rempfer, Tier

Computational Mathematics

The use of computation/simulation as a third alternative to theory and experimentation is now common practice in many branches of science and engineering. Many scientific problems that were previously inaccessible have seen tremendous progress from the use of computation (e.g., many-body simulations in physics and chemistry, simulation of semi-conductors, etc.). Researchers and scientists in these areas must have a sound training in the fundamentals of computational mathematics and become proficient in the use (and development) of new algorithms and analytical techniques as they apply to modern computational environments.

Research and teaching within the computational mathematics group at IIT concentrates on basic numerical analysis, as well as development of new computational methods used in the study and solution of problems in the applied sciences and engineering. In particular, members of the group do research on complexity theory, the finite element method, meshfree methods, multiscale and multilevel methods, Monte Carlo and quasi-Monte Carlo methods, numerical methods for deterministic and stochastic ordinary and partial differential equations, computational fluid dynamics, computational materials science, computer-aided geometric design and parallel computation.

Primary interests: Fasshauer, Hickernell, S. Li, X. Li, Tier

Secondary interests: Duan, Rempfer,

Discrete Applied Mathematics

Discrete applied mathematics is a fairly young branch of mathematics and is concerned with using combinatorics, graph theory, optimization, and portions of theoretical computer science to attack problems in engineering as well as the hard and soft sciences.

Research interests in the discrete applied mathematics group at IIT are in discrete methods in computational and mathematical biology, intersection graphs and their applications, discrete location theory, voting theory applied to data analysis, graph drawing, random geometric graphs, communication networks, coding theory, low discrepancy sequences, algorithm design and analysis.

Primary interests: Ellis, Kaul, Pelsmajer, Reingold

Secondary interests: Hickernell, Kang

Stochastics

Stochastics at IIT includes traditional statistics (the methods of data analysis and inference) and probability (the modeling of uncertainty and randomness). However, also included are other areas where stochastic methods have been becoming more important in recent years such as finite and infinite dimensional stochastic processes, stochastic integration, stochastic dynamics, stochastic partial differential equations, probabilistic methods for analysis, mathematical finance and discrete mathematics, computational methods for stochastic systems, etc.

The current research and teaching interests in the stochastic analysis group at IIT include asymptotics in statistics, experimental design, computational statistics, stochastic calculus and probability theory, stochastic dynamical systems, stochastic control, stochastic partial differential equations and statistical decision theory.

Primary interests: Adler, Bielecki, Cialenco, Duan, Hickernell, Kang, Tier

Secondary interests: Ellis, Kaul

Faculty

Andre Adler, Associate Professor of Applied Mathematics. Ph.D., University of Florida. Asymptotics in statistics, probability, and statistical inference.

Tomasz R. Bielecki, Professor of Applied Mathematics and Director of Master of Mathematical Finance. Ph.D., Warsaw School of Economics. Mathematical finance, stochastic control, stochastic analysis, probability and random processes, quantitative methods for risk management in finance and insurance.

Igor Cialenco, Assistant Professor of Applied Mathematics. Ph.D., University of Southern California. Stochastic processes, stochastic partial differential equations(PDEs), statistical inference for stochastic PDEs, application of stochastic PDEs to mathematical finance, operator theory, spectral analysis of non-selfadjoint operators.

Jinqiao (Jeffrey) Duan, Professor of Applied Mathematics. Ph.D., Cornell University. Stochastic dynamical systems; stochastic partial differential equations; nonlinear dynamical systems; modeling, analysis, simulation and prediction of random, complex and multiscale phenomena in engineering and science (geophysical and environmental systems, etc.)

Warren Edelstein, Professor of Applied Mathematics. Ph.D., Brown University. Analysis of linear viscoelasticity and nonlinear creep, numerical analysis of flow-induced vibrations in tubes conveying fluids, numerical solution of boundary value problems arising in the quantum mechanics of semiconductors. Computational mechanics and mathematics of finance.

Robert B. Ellis, Assistant Professor of Applied Mathematics. Ph.D., University of California at San Diego. Combinatorics, spectral, random and algebraic graph theory, probabilistic methods, coding theory, and combinatorial algorithms.

Gregory Fasshauer, Professor and Associate Chair of Applied Mathematics. Ph.D., Vanderbilt University. Approximation theory, numerical analysis, meshfree methods with applications to multivariate scattered data approximation and the solution of partial differential equations. Computer-aided geometric design and bivariate splines.

Fred J. Hickernell, Professor and Chair of Applied Mathematics. Ph.D., Massachusetts Institute of Technology. Computational mathematics, numerical approximation of integrals and functions, Monte Carlo and quasi-Monte Carlo methods, low discrepancy analysis, information-based complexity theory, design of laboratory and computer experiments, computational finance.

Lulu Kang, Assistant Professor of Applied Mathematics. Ph.D., Georgia Institute of Technology. Non-parametric statistical modeling, Bayesian experimental design, computer experiments, engineering statistics.

Hemanshu Kaul, Assistant Professor of Applied Mathematics. Ph.D., University of Illinois at Urbana-Champaign. Graph theory and combinatorics, discrete optimization and operations research, probabilistic models and mthods in discrete mathematics.

Shuwang Li, Assistant Professor of Applied Mathematics. Ph.D., University of Minnesota, Tewin Cities. Computational materials science and modeling of biosystems, numerical analysis, methods for interface problems in Fluids, Biology and Materials.

Xiaofan Li, Associate Professor of Applied Mathematics and Director of Graduate Studies. Ph.D., University of California, Los Angeles. Computational fluid dynamics, computational materials science. Boundary integral method, moving-boundary value problems. Suspension of particles, phase transformation in materials science.

Arthur Lubin, Associate Professor of Applied Mathematics. Ph.D., University of Wisconsin, Madison. Commuting contractions in Hilbert space, spectral theory, models for analytic functions, linear system theory.

David Maslanka, Senior Lecturer. Ph.D., Illinois Institute of Technology.

Sudhakar E. Nair, Professor of Mechanical and Aerospace Engineering and Professor of Applied Mathematics, and Associate Dean of Academic Affairs, Graduate College. Ph.D., University of California, San Diego. Solid mechanics, elastic and inelastic behavior of materials, applied mathematics, moving boundary problems, wave propagation in anisotropic media.

Faculty (continued)

Michael J. Pelsmajer, Associate Professor of Applied Mathematics. Ph.D., University of Illinois, Urbana-Champaign. Discrete Applied Mathematics: Graph theory, combinatorics, communication networks, algorithms and complexity.

Edward M. Reingold, Professor of Compuer Science and Professor of Applied Mathematics. Ph.D., Cornell University. Analysis of algorithms, data structures, combinatorial algorithms, mathematics, history, and computer implementation of calendars.

Dietmar Rempfer, Associate Professor of Mechanical and Aerospace Engineering and Professor of Applied Mathematics. Ph.D., Habilitation, Universität Stuttgart. Fluid mechanics, especially theoretical studies of transitional and turbulent shear flows in open systems, numerical fluid mechanics, modeling for environmental and urban fluid mechanics, coherent structures in turbulent flows, control of transitional and turbulent wall layers, nonlinear dynamical systems.

Susan S. Sitton, Senior Lecturer. Ph.D., Illinois Institute of Technology.

Charles Tier, Senior Lecturer. Ph.D. Courant Institute of Mathematical Sciences, New York University. Asymptotic and singular perturbation methods, applied stochastic modeling, mathematical biology, queueing models, computational finance.

Admissions Requirements

Cumulative undergraduate GPA minimum: 3.0/4.0
GRE score minimum:
M.S.: 1100 (quantitative + verbal) 2.5 (analytical writing) Ph.D.: 1100 (quantitative + verbal) 3.0 (analytical writing)
TOEFL minimum: 80/213/550
(internet/computer/paper based test scores)
At least two letters of recommendation

Admission to the professional masters program in Mathematical Finance requires a bachelors degree in mathematics, engineering, or equivalent, with a minimum cumulative GPA of 3.0/4.0. TOEFL scores (if required) must have a minimum score of 100/250 (internet/computer-based test score). A professional statement of goals/objectives (2 pages) and a curriculum vitae must be submitted. Two letters of recommendation are required (at least two must be from academia, the third may be from industry). An interview may also be required.

Typically, admitted students score at least 700 on the quantitative portion of the GRE and at least 3.0 on the analytical portion. However, meeting the minimum or typical GPA test-score requirements does not guarantee admission. GPA and test scores are just two of several important factors considered for admission to the program, including grades in mathematics courses, letters of recommendation and the students overall record of achievements.

Admission to the Master of Science and the Ph.D. program normally requires a bachelors degree in mathematics or applied mathematics. Candidates whose degree is in another field (for example, computer science, physics, or engineering) and whose background in mathematics is strong are also eligible for admission and are encouraged to apply. Candidates in the Ph.D. program must also have demonstrated the potential for conducting original research in applied mathematics. Students must remove deficiencies in essential undergraduate courses that are prerequisites for the degree program, in addition to fulfilling all other degree requirements.

The director of graduate studies serves as temporary academic adviser for all newly admitted graduate students until an appropriate faculty member is selected as the adviser. Students are responsible for following all departmental procedures as well as the general requirements of the Graduate College.

Master of Mathematical Finance

Collaborative Program with the Stuart School of Business

33 total credit hours

The objective of the MMF program is to provide individuals interested in pursuing careers in financial risk management with advanced education in theoretical, computational and business aspects of relevant quantitative methodologies. This is a collaborative program between the Stuart School of Business (SSB) and the Applied Mathematics Department (AM) and as such, it will give the students the chance to benefit from the strength of both units. Students are required to complete a total of 11 semester courses, including seven core courses and four elective courses.

Required Courses

MSF 515 Futures, Options and OTC Derivatives
MSF 543 Computational Finance
MATH 542 Stochastic Processes
MATH 548 Mathematical Finance I
MATH 565 Monte Carlo Methods in Finance
MATH 582 Mathematical Finance II
MATH 586 Theory and Practice of Fixed Income Modeling

Elective Courses

A Minimum of four additional courses including: a minimumvof one MATH class must be selected and a minimum two MSF courses must be selected.

Elective Classes from the Department of Applied Mathematics

MATH 512 Partial Differential Equations
MATH 513 PDE's for Finance
MATH 522 Mathematical Modeling
MATH 540 Probability
MATH 543 Introduction to Stochastic Analysis
MATH 544 Stochastic Dynamics
MATH 545 Stochastic Partial Differential Equations
MATH 546 Introduction to Time Series
MATH 566 Mulivariate Analysis
MATH 567 Advanced Design of Experiments
MATH 569 Statistical Learning
MATH 577 Computational Mathematics I
MATH 578 Computational Mathematics II
MATH 579 Complexity of Numerical Problems
MATH 580 Meshfree Methods
MATH 583 Quantitative Modeling of Derivative Securities
MATH 584 Mathematical Portfolio and Investment Theory
MATH 587 Theory and Practice of Modeling Credit Risk and Credit Derivatives
MATH 589 Numerical Methods for PDEs
MATH 590 Meshfree Methods

Elective Classes from the Stuart School

MSF 531 Financial Theory
MSF 532 International Finance Theory
MSF 533 Time Series Analysis
MSF 534 Bayesian Econometrics
MSF 541 Models for Derivatives
MSF 542 Interest Rates, Term Structure and Credit Models
MSF 561 .NET and Database Management
MSF 562 C++ with Financial Applications
MSF 563 OOP and Algorithmic Trading Systems
MSF 572 Structured Fixed Income Portfolios
MSF 573 Quantitative Investment Strategies
MSF 581 Market Risk Management
MSF 582 Credit Risk Management
MSF 583 Enterprise Risk Management
MSF 591 Equity and Equity Derivatives Trading
MSF 592 Fixed Income Trading Strategies
MSF 593 Advanced Options Trading Strategies

Students may also transfer up to two courses (6 credit hours) from a graduate program at another accredited university if the student has not used the classes to satisfy the requirements for a degree at the university.

Master of Science in Applied Mathematics

32 total credit hours
Thesis
Comprehensive exam (Certification)

The M.S. degree program provides a broad background in the fundamentals of the advanced mathematics that is applied to solve problems in the other fields. The goal is to prepare students for careers in industry and for the doctoral program.

Required credit hours

Required courses 12 hours
Research/thesis 1-5 hours
Elective courses 15-19 hours

Required Courses

A Masters thesis (up to 5 credit hours of MATH 591), under the supervision of a faculty member, the colloquium/seminar course MATH 593 (must take it at least twice with satisfactory grade), and at least two of the basic sequences in the four core areas of study:

Applied Analysis

MATH 500 Applied Analysis I
MATH 501 Applied Analysis II

Discrete Applied Mathematics

MATH 553 Discrete Applied Mathematics I
MATH 554 Discrete Applied MathematicsII

Computational Mathematics

MATH 577 Computational Mathematics I
MATH 578 Computational Mathematics II

Stochastics

MATH 543 Stochastic Analysis
MATH 544 Stochastic Dynamics

Elective Courses

The remaining courses in each students program are selected in consultation with, and approval of, the Director of Graduate Studies. The program may include at most three courses at the 400-level and at most two courses outside the department.

The comprehensive examination requirement is fulfilled by achieving certification in two of the core areas of study. For procedures governing the certification process, the student should consult the current department regulations.

Doctor of Philosophy in Applied Mathematics

84 credit hours beyond the bachelors degree
Qualifying exam
Comprehensive exam
Dissertation and Defence

Required credit hours (if entering with a bachelors degree)
Required courses 18 hours
Research/dissertation 24-32 hours
Elective courses 34-42 hours

Required credit hours (if entering with a masters degree)
Required courses 18 hours
Research/dissertation 24-32 hours
Elective courses: 2-10 hours

The Ph.D. program provides advanced education through coursework (including independent study) and original, creative research in order to prepare students for careers in industrial research and academia. The program requires a total of 84 credit hours (approximately 52 for students entering with a masters degree).

The qualifying examination requirement is fulfilled by achieving better than a 3.5/4.0 GPA on the courses taken in three of the core areas of study listed under the M.S. degree and passing an oral examination within the first five semesters of study (within the first three semesters for students entering with a masters degree). The exam covers three of the four core areas, which can be chosen by the student. The comprehensive examination consists of an oral examination based on the students research proposal. The exam aims to ensure that the student has the background to carry out successful research in his/her chosen area and the proposed research has sufficient scholarly merit. Exceptions to these general rules require approval by the departmental Graduate Studies Committee.

Besides the courses in the core areas of study, the remaining courses in the program are selected in consultation with the students academic adviser. The program may include at most three MATH courses at the 400-level. The program requires the student take the colloquium/seminar course MATH 593 at least six times with satisfactory grade. The program must include at least three (but no more than five) courses in an area of concentration outside of the department, as approved by the director of graduate studies; these may include 400-level courses.

The dissertation (thesis) is expected to contain a distinct and substantial, original and publishable contribution to the field of study. The credit hours devoted to thesis research (MATH 691) must total between 24 and 32. An oral examination in defense of the thesis constitutes completion of the degree.

Doctor of Philosophy in Collegiate Mathematics Education

(Joint Program with the Department of Mathematics and Science Education) Details of this Ph.D. program may be found under the Department of Mathematics and Science Education in this Bulletin.

Course Descriptions

Numbers in parentheses represent class, lab and total credit hours, respectively.

MATH 400
Real Analysis
Real numbers, continuous functions; differentiation and Riemann integration. Functions defined by series. Prerequisite: MATH 251 or consent of instructor.
(3-0-3)

MATH 401
Analysis II
Functions of several variables, partial differentiation, and multiple integrals. Prerequisite: MATH 400.
(3-0-3)

MATH 402
Complex Analysis
Analytic functions, conformal mapping, contour integration, series expansions, singularities and residues, and applications. Intended as a first course in the subject for students in the physical sciences and engineering. Prerequisite: MATH 251.
(3-0-3)

MATH 405
Introduction to Iteration and Chaos
Functional iteration and orbits, periodic points and Sharkovsky's cycle theorem, chaos and dynamical systems of dimensions one and two. Julia sets and fractals, physical implications. Prerequisites: MATH 251; MATH 252; one of the following: MATH 332, or MATH 333, or consent of the instructor.
(3-0-3)

MATH 410
Number Theory
Divisibility, congruences, distribution of prime numbers, functions of number theory, diophantine equations, applications to encryption methods. Prerequisite: MATH 230 or consent of instructor.
(3-0-3)

MATH 420
Geometry
The course is focused on selected topics related to fundamental concepts and methods of Euclidean geometry in two and three dimensions and their applications with emphasis on various problem-solving strategies, geometric proof, visualization, and interrelation of different areas of mathematics. Prerequisite: consent of instructor.
(3-0-3)

MATH 425
Statistical Methods
Concepts and methods of gathering, describing and analyzing data including basic statistical reasoning, basic probability, sampling, hypothesis testing, confidence intervals, correlation, regression, forecasting, and nonparametric statistics. No knowledge of calculus is assumed. this course is useful for students in education or the social sciences. This course does not count for graduation in any mathematics programs. Credit not given for both MATH 425 and MATH 476.
(3-0-3)

MATH 426
Statistical Tools for Engineers
Descriptive statistics and graphs, probability distributions, random sampling, independence, significance tests, design of experiments, regression, time-series analysis, statistical process control, introduction to multivariate analysis. Prerequisite: Junior standing. Same as CHE 426. Credit not given for both MATH 426 and CHE 426.
(3-0-3)

MATH 430
Applied Algebra
Relations; modular arithmetic; group theory:symmetry, permutation, cyclic, and abelian groups; group structure: subgroups, cosets, homomorphisms, classification theorems; rings and fields. Applications to crystallography, cryptography, and check-digit schemes. Prerequisite: MATH 230 or MATH 332.
(3-0-3)

MATH 435
Linear Optimization
Introduction to both theoretical and algorithmic aspects of linear optimization: geometry of linear programs, simplex method, anticycling, duality theory and dual simplex method, sensitivity analysis, large scale optimization via Dantzig-Wolfe decomposition and Benders decomposition, interior point methods, network flow problems, integer programming. Credit may not be granted for both MATH 435 and MATH 535. Prerequisite: MATH 332
(3-0-3)

MATH 453
Combinatorics
Permutations and combinations; pigeonhole principle; inclusion-exclusion principle; recurrence relations and generating functions; enumeration under group action. Prerequisite: MATH 230 or consent of instructor.
(3-0-3)

MATH 454
Graph Theory and Applications
Graph theory is the study of systems of points with some of the pairs of points joined by lines. Sample topics include: paths, cycles and trees; adjacency and connectivity; directed graphs; Hamiltonian and Eulerian graphs and digraphs; intersection graphs. Applications to the sciences (computer, life, physical, social) and engineering will be introduced throughout the course. Credit will not be granted for both MATH 454 and MATH 553. Prerequisite: MATH 230, MATH 251 or MATH 252.
(3-0-3)

MATH 461
Fourier Series and Boundary-Value Problems
Fourier series and integrals. The Laplace, heat, and wave equations: Solutions by separation of variables. D'Alembert's solution of the wave equation. Boundary-value problems. Prerequisites: MATH 251, MATH 252.
(3-0-3)

MATH 474
Probability and Statistics
Elementary probability theory including discrete and continuous distributions, sampling, estimation, confidence intervals, hypothesis testing and linear regression. Prerequisite: MATH 251. Credit not granted for both MATH 474 and MATH 475.
(3-0-3)

MATH 475
Probability
Elementary probability theory; combinatorics; random variables; discrete and continuous distributions; joint distributions and moments; transformations and convolution; basic theorems; simulation. Prerequisite: MATH 251. Credit not granted for both MATH 474 and MATH 475.
(3-0-3)

MATH 476
Statistics
Estimation theory; hypothesis tests; confidence intervals; goodness-of-fit tests; correlation and linear regression; analysis of variance; nonparametric methods. Prerequisite: MATH 475.
(3-0-3)

MATH 477
Numerical Linear Algebra
Fundamentals of matrix theory; least squares problems; computer arithmetic; conditioning and stability; direct and iterative methods for linear systems; eigenvalue problems. Credit may not be granted for both MATH 477 and MATH 473. Prerequisite: MATH 350 or consent of instructor.
(3-0-3)

MATH 478
Numerical Methods for Differential Equations
Polynomial interpolation; numerical integration; numerical solution of initial value problems for ordinary differential equations by single and multi-step methods, Runge-Kutta, Predictor-Corrector; numerical solution of boundary value problems for ordinary differential equations by shooting method, finite differences and spectral methods. Prerequisite: MATH 471 or consent of instructor.
(3-0-3)

MATH 481
Introduction to Stochastic Processes
This is an introductory course in stochastic processes. Its purpose is to introduce students to a range of stochastic processes which are used as modeling tools in diverse fields of applications, especially in the business applications. The course introduces the most fundamental ideas in the area of modeling and analysis of real world phenomena in terms of stochastic processes. The course covers different classes of Markov processes: discrete and continuous-time Markov chains, Brownian motion and diffusion processes. It also presents some aspects of stochastic calculus with emphasis on the application to financial modeling and financial engineering. Credit will not be granted for MATH 481 and 542. Prerequisites: (MATH 332 or MATH 333) and MATH 475.
(3-0-3)

MATH 483
Design and Analysis of Experiments
Principles of estimation; hypothesis tests, confidence intervals. Contingency tables; goodness-of-fit. Analysis of variance; linear regression. Hierarchical and split-plot designs; analysis of covariance. Multiple regression. Prerequisite: MATH 476.
(3-0-3)

MATH 485
Introduction to Mathematical Finance
This is an introductory course in mathematical finance. Technical difficulty of the subject is kept at a minimum by considering a discrete time framework. Nevertheless, the major ideas and concepts underlying modern mathematical finance and financial engineering will be explained and illustrated. Credit may not be granted for MATH 485 and MATH 548. Prerequisite: MATH 475 or equivalent.
(3-0-3)

MATH 486
Mathematical Modeling I
A general introduction to optimization problems. Linear programming: the simplex method. Elements of graphs and networks. Introduction to game theory. Applications. Prerequisite: MATH 475 or consent of instructor.
(3-0-3)

MATH 487
Mathematical Modeling II
The formulation of mathematical models, solution of mathematical equations, and interpretation of results. Selected topics from queueing theory and financial derivatives. Prerequisite: MATH 252.
(3-0-3)

MATH 488
Ordinary Differential Equations and Dynamical Systems
Boundary-value problems and Sturm-Liouville theory; linear system theory via eigenvalues and eigenvectors; Floquet theory; nonlinear systems: critical points, linearization, stability concepts, index theory, phase portrait analysis, limit cycles, and stable and unstable manifolds; bifurcation; and chaotic dynamics. Prerequisites: MATH 251, MATH 252.
(3-0-3)

MATH 489
Partial Differential Equations
First-order equations, characteristics. Classification of second-order equations. Laplace's equation: potential theory, Green's function, maximum principles. The wave equation: characteristics, general solution. The heat equation: use of integral transforms. Prerequisite: MATH 461.
(3-0-3)

MATH 491
Reading and Research
Independent reading and research.
((Credit: Variable))

MATH 500
Applied Analysis I
Metric and Normed Spaces; Continuous Functions; Contraction Mapping Theorem; Topological Spaces; Banach Spaces; Hilbert Spaces; Eigenfunction expansion. Prerequisites: MATH 400 or consent of the instructor.
(3-0-3)

MATH 501
Applied Analysis II
Bounded Linear Operators on a Hilbert Space; Spectrum of Bounded Linear Operators; Linear Differential Operators and Green's Functions; Distributions and the Fourier Transform; Measure Theory, Lebesgue Integral and Function Spaces; Differential Calculus and Variational Methods. Prerequisites: MATH 500 or consent of the instructor.
(3-0-3)

MATH 512
Partial Differential Equations
Basic model equations describing wave propagation, diffusion and potential functions; characteristics, Fourier transform, Green function, and eigenfunction expansions; elementary theory of partial differential equations; Sobolev spaces; linear elliptic equations; energy methods; semigroup methods; applications to partial differential equations from engineering and science. Prerequisites: MATH 461 or MATH489 or consent of the instructor.
(3-0-3)

MATH 515
Ordinary Differential Equations and Dynamical Systems
Basic theory of systems of ordinary differential equations; equilibrium solutions, linearization and stability; phase portraits analysis; stable, unstable and center manifolds; periodic orbits, homoclinic and heteroclinic orbits; bifurcations and chaos; nonautonomous dynamics; and numerical simulation of nonlinear dynamics. Prerequisites: MATH 252 or consent of the instructor.
(3-0-3)

MATH 519
Complex Analysis
Analytic functions, contour integration, singularities, series, conformal mapping, analytic continuation, multivalued functions. Prerequisite: MATH 402 or consent of instructor.
(3-0-3)

MATH 522
Mathematical Modeling
The primary goal of this course is to provide students the power of using the principles and methods of mathematical modeling for studies of complex systems in science and engineering. The students will be introduced to the basic notions of the level abstractions, and on how to work on real problems at different levels. The emphasis throughout is on the synergy between the rigorous mathematical approaches, accurate choice of scientific approximation, engineering estimates, and data analysis. A broad range of physical phenomena, engineering applications as well as biological systems will be considered. The use of methods of applied analysis, theoretical physics, probability and statistics will be described. Credit may not be granted for both MATH 486 and MATH 522. Prerequisites: MATH 475 and MATH 461 or consent of instructor.
(3-0-3)

MATH 525
Statistical Models and Methods
Concepts and methods of gathering, describing and analyzing data including basic statistical reasoning, basic probability, sampling, hypothesis testing, confidence intervals, correlation, regression, forecasting, and nonparametric statistics. No knowledge of calculus is assumed. This course is useful for students in education or the social sciences. This course does not count for graduation in any mathematics programs. Credit not given for both MATH 425 and MATH 525.
(3-0-3)

MATH 530
Algebra
Axiomatic treatment of groups, rings and fields, ideals and homomorphisms; field extensions, modules over rings. Prerequisite: MATH 332 or MATH 430.
(3-0-3)

MATH 532
Linear Algebra
Matrix algebra, vector spaces, norms, inner products and orthogonality, determinants, linear transformations, eigenvalues and eigenvectors, Cayley-Hamilton theorem, matrix factorizations (LU, QR, SVD). Prerequisites: MATH 332 or consent of the instructor.
(3-0-3)

MATH 535
Optimization I
Introduction to both theoretical and algorithmic aspects of linear optimization: geometry of linear programs, simplex method, anticycling, duality theory and dual simplex method, sensitivity analysis, large scale optimization via Dantzig- Wolfe decomposition and Benders decomposition, interior point methods, network flow problems, integer programming. Credit may not be granted for both MATH 435 and MATH 535. Prerequisite: MATH 332.
(3-0-3)

MATH 540
Probability
Random events and variables, probability distributions, sequences of random variables and limit theorems. Prerequisite: MATH 400, MATH 475, or consent of instructor.
(3-0-3)

MATH 542
Stochastic Processes
This is an introductory course in stochastic processes. Its purpose is to introduce students to a range of stochastic processes, which are used as modeling tools in diverse fields of applications, especially in the business applications. The course introduces the most fundamental ideas in the area of modeling and analysis of real world phenomena in terms of stochastic processes. The course covers different classes of Markov processes: discrete and continuous-time Markov chains, Brownian motion and diffusion processes. It also presents some aspects of stochastic calculus with emphasis on the application to financial modeling and finanacial engineering. Credits cannot be given to both Math 481 and Math 542. Prerequisite: MATH 332 or MATH 333
(3-0-3)

MATH 543
Stochastic Analysis
This course will introduce the student to modern finite dimensional stochastic analysis and its applications. The topics will include: an overview of modern theory of stochastic processes, with focus on semimartingales and their characteristics, stochastic calculus for semimartingales, including Ito formula and stochastic integration with respect to semimartingales, stochastic differential equations (SDE's) driven by semimartingales, with focus on stochastic SDE's driven by Levy processes, absolutely continuous changes of measures for semimartingales, some selected applications. Prerequisite: MATH 475 or consent of instructor.
(3-0-3)

MATH 544
Stochastic Dynamics
This course is about modeling, analysis, simulation and prediction of dynamical behavior of complex systems under random influences. The mathematical models for such systems are in the form of stochastic differential equations. It is especially appropriate for graduate students who would like to use stochastic methods in their research, or to learn these methods for long term career development. Topics include white noise and colored noise, stochastic differential equations, random dynamical systems, numerical simulation, and applications to scientific, engineering and other areas. Prerequisite: MATH 474, MATH 475 or MATH 543 or equivalent.
(3-0-3)

MATH 545
Stochastic Partial Differential Equations
This course introduces various methods for understanding solutions and dynamical behaviors of stochastic partial differential equations arising from mathematical modeling in science and engineering and other areas. It is designed for graduate students who would like to use stochastic methods in their research or to learn such methods for long term career development. Topics include: Random variables, Brownian motion and stochastic calculus in Hilbert spaces; Stochastic heat equation; Stochastic wave equation; Analytical and approximation techniques; Stochastic numerical simulations via Matlab; Dynamical impact of noises; Stochastic flows and cocycles; Invariant measures, Lyapunov exponents and ergodicity; and applications to engineering and science and other areas. Prerequisites: MATH 543 or MATH 544 or consent of instructor.
(3-0-3)

MATH 546
Introduction to Time Series
Properties of stationary, random processes; standard discrete parameter models, autoregressive, moving average, harmonic; standard continuous parameter models. Spectral analysis of stationary processes, relationship between the spectral density function and the autocorrelation function; spectral representation of some stationary processes; linear transformations and filters. Introduction to estimation in the time and frequency domains. Prerequisite: MATH 475 or ECE 511.
(3-0-3)

MATH 548
Mathematical Finance I
This is an introductory course in mathematical finance. Technical difficulty of the subject is kept at a minimum by considering a discrete time framework. Nevertheless, the major ideas and concepts underlying modern mathematical finance and financial engineering will be explained and illustrated. Credits cannot be given to both Math 485 and Math 548. Prerequisite: MATH 474 or MATH 475.
(3-0-3)

MATH 550
Topology
Topological spaces, continuous mappings and homoeomorphisms, metric spaces and metrizability, connectedness and compactness, homotopy theory. Prerequisite: MATH 556.
(3-0-3)

MATH 553
Discrete Applied Mathematics I
Graph theory is the study of systems of points with some of the pairs of points joined by lines. Sample topics include: paths, cycles and trees; adjacency and connectivity; directed graphs; Hamiltonian and Eulerian graphs and digraphs; intersection graphs. Applications to the sciences (computer, life, physical, social) and engineering will be introduced throughout the course. This course runs concurrently with Math 454 but projects and homework are at the graduate level. Credits cannot be given to both MATH 553 and MATH 454. Prerequisite: Math 453 or consent of instructor.
(3-0-3)

MATH 554
Discrete Applied Mathematics II
Graduate level treatment of applied combinatorics; posets: product and dimension, lattices, extremal set theory and symmetric chain decomposition; combinatorial designs: block designs, Latin Squares, finite fields, block designs and Steiner systems, finite projective planes; coding theory: error-correcting codes, Hamming and sphere bounds, linear codes, codes from liar games and adaptive coding. Prerequisite: MATH 453, MATH 454, or MATH 553.
(3-0-3)

MATH 555
Tensor Analysis
Development of the calculus of tensors with applications to differential geometry and the formulation of the fundamental equations in various fields. Prerequisites: MATH 332 and either MATH 400 or consent of instructor.
(3-0-3)

MATH 556
Metric Spaces
Point-set theory, compactness, completeness, connectedness, total boundedness, density, category, uniform continuity and convergence, Stone-Weierstrass theorem, fixedpoint theorems. Prerequisite: MATH 400.
(3-0-3)

MATH 557
Probabilistic Methods in Combinatorics
Graduate level introduction to probabilistic methods, including linearity of expectation, the deletion method, the second moment method and the Lovsz Local Lemma. Many examples from classical results and recent research in combinatorics and graph theory will be included throughout, including from Ramsey Theory, random graphs, coding theory, and number theory. Prerequisite: graduate status or consent of instructor.
(3-0-3)

MATH 563
Statistics
Theory of limiting distributions; interval and point estimation, sufficient statistics. Bayesian procedures, hypothesis testing, nonparametric methods. Prerequisite: MATH 475.
(3-0-3)

MATH 564
Applied Statistics
Linear regression and correlation models, regression parameters, prediction and confidence intervals, time series, analysis of variance and covariance. Prerequisites: MATH 332 and MATH 475, or consent of instructor.
(3-0-3)

MATH 565
Monte Carlo Methods in Finance
In addition to the theoretical constructs in financial mathematics, there are also a range of computational/ simulation techniques that allow for the numerical evaluation of a wide range of financial securities. This course will introduce the student to some such simulation techniques, known as Monte Carlo methods, with focus on applications in financial risk management. Monte Carlo and Quasi Monte Carlo techniques are computational sampling methods which track the behavior of the underlying securities in an option or portfolio and determine the derivative's value by taking the expected value of the discounted payoffs at maturity. Recent developments with parallel programming techniques and computer clusters have made these methods widespread in the finance industry. Prerequisite: MATH 474.
(3-0-3)

MATH 566
Multivariate Analysis
Random vectors, sample geometry and random sampling, generalized variance, multivariate normal and Wishart distributions, estimation of mean vector, confidence region, Hotelling's T2, covariance, principal components, factor analysis, discrimination, clustering. Prerequisites: MATH 532, MATH 563, MATH 564.
(3-0-3)

MATH 567
Advanced Design of Experiments
Various type of designs for laboratory and computer experiments, including fractional factorial designs, optimal designs and space filling designs. Prerequisites: MATH 476 or MATH 474.
(3-0-3)

MATH 568
Topics in Statistics
Categorical data analysis, contingency tables, log-linear models, nonparametric methods, sampling techniques. Prerequisite: MATH 563.
(3-0-3)

MATH 569
Statistical Learning
The wealth of observational and experimental data available provides great opportunities for us to learn more about our world. This course teaches modern statistical methods for learning from data, such as, regression, classification, kernel methods, and support vector machines. Prerequisites: MATH 350 and MATH 474 or MATH 475, or consent of instructor.
(3-0-3)

MATH 577
Computational Mathematics I
Fundamentals of matrix theory, least squares problems, computer arithmetic, conditioning and stability, direct and iterative methods for linear systems, eigenvalue problems. Credits cannot be given to both Math477 and Math577. Prerequisite: an undergraduate numerical course, such as MATH 350 or consent of instructor.
(3-0-3)

MATH 578
Computational Mathematics II
Polynomial interpolation; numerical integration; numerical solution of ordinary differential equations by single and multi-step methods, Runge- Kutta, Predictor-Corrector; numerical solution of boundary value problems for ordinary differential equations by shooting methods, finite differences and spectral methods. Credits cannot be granted for both MATH 578 and MATH 478. Prerequisite: an undergraduate numerical course, such as MATH 350 or consent of instructor.
(3-0-3)

MATH 579
Complexity of Numerical Problems
This course is concerned with a branch of complexity theory. It studies the intrinsic complexity of numerical problems, that is, the minimum effort required for the approximate solution of a given problem up to a given error. Based on a precise theoretical foundation, lower bounds are established, i.e. bounds that hold for all algorithms. We also study the optimality of known algorithms, and describe ways to develop new algorithms if the known ones are not optimal. Prerequisite: MATH 471.
(3-0-3)

MATH 581
Theory of Finite Elements
The geometry of the various elements, the element matrices, assembly of stiffness matrices, analysis of error estimates and convergence proofs. Applications. Prerequisite: MATH 400 or consent of instructor.
(3-0-3)

MATH 582
Mathematical Finance II
This course is a continuation of Math 485/548. It introduces the student to modern continuous time mathematical finance. The major objective of the course is to present main mathematical methodologies and models underlying the area of financial engineering, and, in particular, those that provide a formal analytical basis for valuation and hedging of financial securities. Prerequisite: MATH 485/548; MATH 481/542, or consent of instructor.
(3-0-3)

MATH 586
Theory and Practice of Fixed Income Modeling
The course covers basics of the modern interest rate modeling and fixed income asset pricing. The main goal is to develop a practical understanding of the core methods and approaches used in practice to model interest rates and to price and hedge interest rate contingent securities. The emphasis of the course is practical rather than purely theoretical. A fundamental objective of the course is to enable the students to gain a hand-on familiarity with and understanding of the modern approaches used in practice to model interest rate markets. Prerequisite: MATH 543 or MATH 485 or consent of instructor. Corequisite: MATH 582.
(3-0-3)

MATH 587
Theory and Practice of Modeling Risk and Credit Derivatives
This is an advanced course in the theory and practice of credit risk and credit derivatives. Students will get acquainted with structural and reduced form approaches to mathematical modeling of credit risk. Various aspects of valuation and hedging of defaultable claims will be presented. In addition, valuation and hedging of vanilla credit derivatives, such as credit default swaps, as well as vanilla credit basket derivatives, such as collateralized credit obligations, will be discussed. Prerequisite: MATH 582 or equivalent.
(3-0-3)

MATH 589
Numerical Methods for Partial Differential Equations
The course introduces numerical methods especially finite difference method for solving different types of partial different equations. The main numerical issues such as convergence and stability will be discussed. It also includes introduction to finite volume method, finite element method and spectral method. Prerequisite: a undergraduate numerical course such as MATH 350 and MATH 489 or consent of instructor.
(3-0-3)

MATH 590
Meshfree Methods
Fundamentals of multivariate meshfree radial basis function and moving least squares methods; applications to multivariate interpolation and least squares approximation problems; applications to the numerical solution of partial differential equations; implementation in Matlab. Prerequisite: Consent of instructor.
(3-0-3)

MATH 591
Research and Thesis for M.S. Degree
(Credit Variable)

MATH 593
Seminar in Applied Mathematics
Current research topics presented in the department colloquia and seminars.
(1-0-0)

MATH 594
Special Projects
(Credit Variable)

MATH 595
Geometry for Teachers
The course is focused on fundamental ideas and methods related to Euclidean and Non-Euclidean (e.g., spherical) geometries in two and three dimensions and their applications with emphasis on the use of technology (e.g., Geometer's Sketchpad or Cabri dynamic geometry software) and relevance to geometric concepts in the pre-college mathematics curriculum context. Various problem-solving approaches and strategies will be emphasized based on posing hypotheses, their experimental testing and investigation, the use of formal axiomatic systems to construct and analyze proofs of the corresponding geometric theorems, and visual interpretations of the results. Participants will also complete an independent study module on some aspect of Non- Euclidean geometry not addressed in the course (e.g., read and report on the book, Flatland). The course is designed as a mathematics course for graduate students in the mathematics education and certification option programs, and for practicing secondary mathematics teachers. Prerequisites: 18 semester hours of an undergraduate mathematics major completed, certification as a mathematics teacher or consent of instructor.
(3-0-3)

MATH 596
Math For Teachers: Elementary
An in-service workshop for precollege teachers emphasizing the phenomenological approach to the teaching of mathematics. Prerequisite: Certification as mathematics teacher or approval of the instructor.
(Credit Variable)

MATH 597
Reading and Special Projects
(Credit: Variable)

MATH 598
Math For Teachers: High School
An in-service workshop for pre–college teachers emphasizing the phenomenonological approach to teaching of integrated mathematics and science at the high school level. Prerequisite: Certification as teacher or approval of instructor.
(Credit: Variable)

MATH 599
TA Training
This course provides the foundation of how to teach mathematics in the context of introductory undergraduate courses. The course is designed to encourage participation and cooperation among the graduate students, to help them prepare for a career in academia, and to help convey the many components of effective teaching.
(1-0-0)

MATH 601
Advanced Topics in Combinatorics
Course content is variable and reflects current research in combinatorics. Prerequisite: MATH 554 or consent of instructor.
(3-0-3)

MATH 602
Advanced Topics in Graph Theory
Course content is variable and reflects current research in graph theory. Prerequisite: MATH 554 or consent of instructo.
(3-0-3)

MATH 603
Advanced Topics in Computational Mathematics
Course content is variable and reflects current research in computational mathematics. Prerequisite: MATH 578 or consent of instructor.
(3-0-3)

MATH 604
Advanced Topics in Applied Analysis
Course content is variable and reflects current research in applied analysis. Prerequisite: MATH 501 or consent of instructor.
(3-0-3)

MATH 605
Advanced Topics in Stochastics
Course content is variable and reflects current research in stochastics. Prerequisite: MATH 544 or consent of instructor.

(3-0-3)

MATH 691
Research and Thesis Ph.D.
(Credit: Variable)

School of Applied Technology

Daniel F. and Ada L. Rice Campus
Illinois Institute of Technology
201 E. Loop Road
Wheaton, IL 60187
630.682.6000
www.iit.edu/applied_tech/

Dean and Academic Director, Information Technology and Management Programs:
C. Robert Carlson

Executive Assistant to the Dean:
Barbara Kozi

Director, Professional Learning Programs:
Carl Vizza

Interim Director, Industrial Technology and Management Programs:
Mazin Safar

Director, Marketing & Development:
Scott Pfeiffer

Director, Information Technology:
Ray Trygstad

Director, IIT Online:
Lauren Wood

The School of Applied Technology (SAT) draws on IITs extensive experience in adult education to offer technology-oriented training and education for working professionals. Courses are taught by IIT professors and industry professionals with significant working, teaching, and research experience in their fields. The IIT School of Applied Technology offers education and training in a wide variety of formats including degree, non-degree, certificate, credit and non-credit programs; corporate training; short courses; and seminars ranging from a few hours to several days in length. Completion of all IIT School of Applied Technology non-credit courses will result in the assignment of Continuing Education Units (CEU) fully accredited by the International Association for Continuing Education and Training (IACET). Through IIT Online, the IIT School of Applied Technology markets and manages online delivery of IIT degree and non-degree educational offerings in all disciplines.

The IIT School of Applied Technology is based at the Daniel F. and Ada L. Rice Campus in Wheaton, Illinois, but also has a substantial presence at IIT's Main Campus in Chicago. The Industrial Technology and Management degree programs and IIT Online are located at the Main Campus, and both the Information Technology and Management degree programs and the Professional Learning Programs operate extensively on the Main Campus as well.

Degrees Offered

Master of Information Technology and Management
Master of Industrial Technology and Operations

Master of Information Technology and Management

This 30-credit-hour course-only masters degree program is designed for working professionals who have a four year degree from an accredited college or university. Students can find more information and program description in the Information Technology and Management section of this bulletin or visit www.iit.edu/applied_tech/.

Master of Industrial Technology and Operations

This is a 30 credit-hour, course-only masters degree program designed for those who plan to make a career in industry and have a four-year degree from an accredited college or university. For more information and program description, please consult the Industrial Technology and Management section of this bulletin or visit www.iit.edu/applied_tech/.

Certificate Programs

Advanced Software Development
Computer and Network Security Technologies
Data Center Operations and Management
Data Management and Analytics
Digital Voice & Data Communication Technologies
Information Security Management
Information Technology Innovation, Leadership and Entrepreneurship
Systems Analysis
System Administration Certificate
Web Design and Application Development

Professional Learning Programs

Information Technology Certificate Programs
Manufacturing/Industrial Technology Certificate Programs
Professional Engineer (EI) Engineering Intern (EI) Review
Short Course (one to five days) in all disciplines

Professional Learning Programs

Professional Learning Programs offer hands-on training classes designed for professionals who are either looking to upgrade their existing skills or make a career change into another field. All classes are held in stateof- the-art classrooms and computer labs and are taught by IIT faculty members or by industry professionals who enhance the learning process with real-world knowledge and experience.

Particular areas of focus include information technology, manufacturing and industrial technology and management, and engineering, but all other disciplines within the university are represented as well. Courses are available as ten to seventeen week certificate programs, as corporate training and as short courses and seminars ranging from a few hours to several days in length. Instructor-mediated online courses are also available. All courses are designed to meet professional continuing education requirements and carry Continuing Education Unit (CEU) credit.

Detailed information regarding the course offerings of IITs Professional Learning Programs is available at www.iit.edu/applied_tech or by calling 630.682.6035.

IIT Online

Online learning at IIT allows students to view course lectures and download course materials from the Internet from anywhere on earth. While each academic department and program determines the availability of online courses and degrees, it is the role of IIT Online to market and manage the online delivery of IIT degree and non-degree educational offerings across all university disciplines. IIT Online has developed a set of internet and online solutions and services to accommodate different instructional and managerial needs. These solutions range from rapid delivery with live recording of traditional classroom courses and immediate release to the online classroom, to formal studio productions accompanied by a full cycle of Instructional Design development. Whether delivering just-in-time or fully customized solutions, IIT Online is committed to quality remote learning and making innovative use of technology to enhance learning outcomes. Placing the learner at the center of the educational practice, IIT Online has developed a methodology for making the best use of technology and promoting quality interactive educational experiences for students all over the world. For more information on IIT Online and their role in an IIT education please see http://iit-online.iit.edu/.

College of Architecture

S.R. Crown Hall
3360 S. State St.
Chicago, IL 60616
312.567.3230
312.567.5820 fax
arch@iit.edu
www.arch.iit.edu

Dean:
Donna V. Robertson
John and Jeanne Rowe Chair

Associate Dean:
Peter Beltemacchi

Assistant Dean for Undergraduate Academic Affairs:
R. Stephen Sennott

Director for Graduate Academic Affairs:
Kate Fitzgibbon

Director of Doctor of Philosophy (Ph.D.) in Architecture Program:
Mahjoub Elnimeiri

Director of Thesis:
Dirk Denison

Director of Landscape Architecture Program:
Peter L. Osler

Director for Buildings and Operations:
Richard Nelson

Director of Graduate Admissions, Director of International Affairs
Timothy Brown

Mission

The College of Architecture's graduate degree programs emphasize investigations in architectural design and technology, while expanding the significance of such investigations through rigorous, critical thought. The College draws strength from its Mies van der Rohe heritage, its key position in the legacy of Modernism, its location in Chicago, and its connections to progressive practitioners and emerging global architectural practices. Our students, faculty and alumni are intellectually serious, professional and international.

Architectural education at IIT offers unique combinations, intertwining design and technology to produce advanced architecture. Our commitment includes the needs of our South Side Chicago neighborhood, our city and its inhabitants. Our perspective is inclusive of architecture's allied disciplines and committed to the highest quality in our students' professional preparation. Our mission relies on certain guiding values: design excellence, technical expertise, advanced professional practice, and respect for the architect in society today as an ethical, thoughtful and informed producer not only of buildings, but also of all visual and physical environments. The College of Architecture is a force for quality built environments and society's advancement through a humane use of technology, materials, space and form.

Accreditation

In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit U.S. professional degree programs in architecture, recognizes three types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture. A program may be granted a 6-year, 3-year, or 2-year term of accreditation, depending on the extent of its conformance with established educational standards.

Master's degree programs may consist of a preprofessional undergraduate degree and a professional graduate degree that, when earned sequentially, constitute an accredited professional education. However, the preprofessional degree is not, by itself, recognized as an accredited degree.

The College of Architecture has two NAAB accredited degrees: the Bachelor of Architecture and the Master of Architecture Professional Degree Programs. Both hold 6-year terms of accreditation with the NAAB.

The Master of Landscape Architecture degree underwent initial review for accreditation by the Landscape Architectural Accreditation Board (LAAB). Accreditation status will be confirmed by Fall 2010.

Degrees Offered

Master of Architecture (Professional Degree) (M. Arch.)
Master of Science in Architecture (Post-Professional Degree)(M.S.Arch.)
Master of Integrated Building Delivery (Post-Professional Degree)(M.I.B.D.)
Master of Landscape Architecture (M.L.A.)
Doctor of Philosophy in Architecture (Ph.D.)

Research Facilities

The College of Architecture is housed in three buildings designed by Mies van der Rohe: S.R. Crown Hall, 3410 S. State St., and the Minerals and Metals Building. With more than 112,000 sq. feet dedicated exclusively to the College, along with seminar and classrooms utilizing many IIT campus facilities, students have some of the finest instructional spaces in the United States.

A branch of the Paul V. Galvin Library, the Graham Resource Center (GRC) is the main library for College of Architecture (CoA) students and faculty. Housed in Crown Hall, the GRC houses over 16,000 books, a number of architecture specific databases and 55 journal subscriptions. The GRC is charged with meeting all library-related needs of the CoA and responsibilities include: acquiring, preserving, and serving materials in myriad media to CoA students, faculty, and staff; maintaining additional resources, including the Crown Hall darkroom, the CoA Archives, the Graham Resource Center Web Page, and an Audio-Visual equipment collection; providing reference and research assistance to local, national, and international clients about architecture in general and IIT and Mies van der Rohe in particular; and providing bibliographic instruction to all GRC and Architecture researchers and users.

The Architecture Materials Lab has 5,200 square feet of shop facilities in three locations for the exclusive use of architecture students. The lab contains tools and machinery for working with wood, metal, plastics and includes a large paint booth. The facility houses three Universal Laser Systems 60W Laser Cutters, a Bridgeport Series I Vertical CNC Machine and a Precix Series 9100 CNC Router for digital fabrication.

The College houses two computer labs, with a third instruction lab in Siegel Hall, with over 70 PCs outfitted with the latest Architectural Digital Design and Fabrication software. All Labs and requisite software are listed here: http://www.iit.edu/ots/computer_labs.shtml. The Lab PCs are updated every third year to support curriculum initiatives and technology advances, such as BIM (Building Information Modeling), and serve as digital imaging and rendering instruction spaces for the College. When not in use for class, the Labs are open to students and offer 24 hr. access for several weeks at the end of the semester. The two labs support myriad printing and output media including four plotters for student use. In addition, the Office of Technology Services printing system allows students to print remotely to any printer on campus, including the aforementioned plotters. The university campus is a wireless zone serving the IIT community.

Research Areas

Faculty and doctoral candidates conduct research on a wide range of important topics related to the theory and practice of architecture and the construction of significant buildings at all scales. Thesis students investigate projects involving the design, planning and structure of high-rise buildings; the research, planning and design of large-scale projects such as stadiums, airports, convention centers, institutional buildings and commercial facilities; technological applications such as new materials, composites, prefabricated applications, systems of building enclosure, and other methods of construction; emerging urbanisms, including global practices of architecture and new urban cultures; the influence of climate and environment upon building form, sustainable design and energy efficiency; biophilic design; advanced critical analysis and architectural history/theory; computer applications such as 3-D modeling, multimedia and graphic image presentations, concepts of animation, and 3-D modeling techniques and approaches; and housing, including high-density, low-density, and affordable housing.

Faculty

Peter Beltemacchi, Associate Professor and Associate Dean. B.S., M.S., Illinois Institute of Technology. Urban design and city and regional planning.

Thomas Brock, Assistant Professor. B.Arch. University of Cincinnati; M. Arch., University of Pennsylvania. Architectural design, construction technologies and digital media.

Marshall Brown, Assistant Professor. B.Arch. Washington University; M.Arch., MAUD, Harvard University. Architectural design and theory, urbanism.

Timothy Brown, Studio Associate Professor, Director of Admissions, Director of International Affairs. B.S.Arch., Clemson University; M.Arch., University of Illinois, Chicago. Architectural design and theory.

Susan Conger-Austin, Assistant Professor, Director of Thesis. B.A., Stanford University; M.Arch., Princeton University. Architectural design and theory.

Dirk Denison, Associate Professor. B.Arch., M.B.A., Illinois Institute of Technology; M.Arch., Harvard University. Architectural design, community design and community planning.

John Durbrow, Assistant Professor. B.Arch., B.A. Fine Arts, Rice University. Architectural design, materials and technologies, planning, furniture design.

Mahjoub Elnimeiri, Professor and Director of Ph.D. in Architecture Program. B.S., University of Khartoum; M.S., University of London, Imperial College; Ph.D., Northwestern University. Structural engineering, and sustainability.

Martin Felsen, Studio Associate Professor. B.Arch., Virginia Polytechnic Institute; M.S., Columbia University. Architectural design, urban design, and digital technolgies.

Frank Flury, Associate Professor. M.Arch. Diploma, University of Karlsruhe. Architectural design, design/build.

David Goodman, Studio Associate Professor. B.A., B.S., Cornell University; M.Arch., Harvard University. Architectural design and theory.

Gerald Horn, Studio Professor. Architectural design, mixed-use development, design analysis.

David Hovey, Associate Professor. B.Arch., M.S.Arch., Illinois Institute of Technology. Architectural design, medium- and high-density housing, design analysis, real estate development.

Chris Karidis, Studio Professor. B.Arch., Illinois Institute of Technology. Architectural design and building technology.

Thomas Kearns, Studio Associate Professor. B.Arch., Iowa State University. Architectural design and theory, digital technologies.

Sean Keller, Assistant Professor. B.A., M.Arch., Princeton University; Ph.D. Harvard University. Architectural history and theory.

Robert Krawczyk, Associate Professor and Director, Undergraduate Programs. B.Arch., University of Illinois, Chicago. Computer-aided design and advanced digital applications.

Ron Krueck, Studio Professor. B.Arch., Illinois Institute of Technology. Architectural design and theory.

Eva Kultermann, Assistant Professor. B.Arch., University of Arkansas; M.S., Oxford Brookes University. Design and theory, design build, sustainability.

Peter Land, Professor. Dipl. Arch., Architectural Association; M.Arch., Carnegie Institute of Technology; M.C.P., Yale University. Innovative structures, building technologies and materials. Low-energy design; high-density, low-rise housing; urbanism and planning.

Harry Francis Mallgrave, Professor, Director, International Center for Sustainable New Cities. B.E.S., MArch., University of Detroit; Ph.D., University of Pennsylvania. History and theory of architecture.

Thomas J. McLeish, Studio Associate Professor. B.Arch., B.S., Ball State University; M.S., Massachusetts Institute of Technology. Digital technology in practice, digital design and fabrication.

Jonathan Miller, Studio Associate Professor. B.A., Yale University; M.F.A., New York University. Architectural design and theory; film studies.

Kathleen Nagle, Studio Associate Professor. B.A., Williams College; M.Arch., Harvard University. Architectural design, introduction to architecture.

Richard Nelson, Studio Associate Professor. Director for Buildings and Operations B.A. & M. Arch., Washington University. Architectural Design & Building Technology

Peter L. Osler, Assistant Professor and Director, Landscape Architecture Program. B.S. Natural Resources, University of Michigan; M.L.A., M. Arch., Harvard University; Fellow, American Academy in Rome.

Alphonso Peluso, Studio Assistant Professor. B.Arch., Illinois Institute of Technology. Digital design.

Paul Pettigrew, Studio Associate Professor. B.S.Arch., University of Illinois, Champaign-Urbana; M.Arch., Massachusetts Institute of Technology. Architectural design, furniture design and build.

Benjamin R. Riley, Assistant Professor. B. Arch., Illinois Institute of Technology. Architectural design, building technology, visual training.

Donna V. Robertson, Professor and Dean. John and Jeanne Rowe Chair. B.A., Stanford University; M.Arch., University of Virginia. Architectural design and practice. Preservation, case study methodology.

Christopher Rockey, Assistant Professor. B.S., M.Arch., University of Illinois at Urbana-Champaign. Structural engineering, constructability, efficiency.

Peter Roesch, Studio Associate Professor. Ingenieur fur Hochbau, Staatsbauschule Coburg (Germany); M.S.Arch., Illinois Institute of Technology. Architectural design, medium- and high-density housing, and urban design.

John Ronan, Associate Professor and Director, Advanced Studios. B.S., University of Michigan; M.Arch., Harvard University Graduate School of Design. Architectural design and material investigation.

Andrew Schachman, Studio Assistant Professor. B.A., University of Chicago; M.Arch. University of Illinois at Chicago. Architectural design and theory.

George Schipporeit, Associate Professor. Building technology and systems, high-rise design, medium- and high-density housing, and sustainable new cities.

Christian Stutzki, Studio Professor, Ph.D., RWTH Aachen, Germany. Structural engineering, faade and glass technology

Arthur Takeuchi, Associate Professor. B.Arch., M.S.Arch., Illinois Institute of Technology. Space problem, visual training, and building systems.

Catherine Wetzel, Associate Professor. B.Arch., University of Cincinnati; M.Arch., University of Pennsylvania. Architectural design and practice.

Antony Wood, Studio Associate Professor and CTBUH Executive Director (Council on Tall Buildings and Urban Habitat) B.A., BArch., PGDipArchPrac. PGCHE. University of Nottingham, UK. Tall buildings and sustainable design.

Admission Requirements for Graduate Programs

Completed application form
Cumulative Undergraduate GPA: minimum 3.0/4.0
Portfolio
Three letters of recommendation
Statement of intent
Official transcripts
GRE score minimum: 900 combined, 2.5 analytical writing
TOEFL minimum: 80/550 (internet/paper-based test scores)
Application Fee of $40

All programs require a minimum undergraduate grade point average of 3.0 on a 4.0 scale.

Applicants must submit a portfolio of previous academic or professional work in a portable and professionally acceptable format (8.5 by 11 inches or smaller), three letters of recommendation from individuals able to appraise the applicant's achievement and potential, a statement of intent describing academic and professional objectives as well as why they would like to study at IIT, and GRE scores, which are less than five years old.

International applicants from non-English speaking countries are required to submit TOEFL scores of 550/80 (paper-based test score scale/internet-based) or above. Admitted international students with TOEFL scores between 550/80 and 600/100 will be required to take an English proficiency exam upon arrival at IIT; in addition, they may be required to take additional courses to develop their language skills. English language courses required for international students do not apply to program credit hours. Admitted international students must submit an affidavit of financial support confirming adequate funding for their entire term of study and a copy of their passport. Visa documents cannot be issued unless both the financial affidavit and passport are on file with the College of Architecture.

Although we encourage early submission, completed applications and all supporting documents must be received by the deadline for each program. Late applicants will be reviewed only if space is available.

For the graduate programs to achieve their objectives, it is necessary to restrict the number of students admitted. Admission to the graduate programs is limited by College requirements. All applicants are considered on a competitive basis, with every effort being made to select outstanding candidates.

Master of Architecture - Professional Degree

The Master of Architecture first professional degree serves those students seeking a consummate professional education. The degree is accredited by the National Architectural Accreditation Board (NAAB), and is a necessary component for licensure in the field.

The IIT College of Architecture's graduate professional Architecture degree program emphasizes the integration of architectural design, theory, and technology. Through rigorous work and critical thought, the college promotes innovation and underscores refinement with the obejctive of developing outstanding proficiency in the practice of architecture.

The College draws strength from its legacy of Mies van der Rohe, as well as from its own contributions to modern theory and practice. Our argument is that the poetics of space are inseparable from the practical and significant understanding of materials and fabrication. The strength of the curriculum lies in rigorously unfolding the implications of this position.

Our location in Chicago is central to our understanding of architecture as an urban art, which is greatly enriched by the vibrant culture of our city and the influence of its progressive and global architectural practices.

Our mission is to teach design excellence and technical expertise, and to foster an understanding of the role of the architect in society as an ethical, insightful, and informed leader. We believe that society sustains and enriches itself through thoughtful planning and careful work, and we regard the architect as the central figure who is best able to synthesize the natural and man-made in the creation of a more humane built environment.

The curriculum addresses principles of design concepts, materials, construction, systems, planning, professional practice, history and visual judgment, which are fundamental for development of the creative process. The curriculum is progressive with required core coursework offering foundation knowledge, skills and vocabulary, while upper-level study seeks a broader understanding of architecture by combining theoretical exploration with practical considerations.

The program culminates in an independent Master's Project, which demonstrates excellence in design with a final product that is environmentally conscious, socially responsible, and technologically advanced. The Master's Projects are grouped into areas of focus that include but are not limited to: sustainable cities, building delivery practices, community based planning, history and theory, advanced technologies, housing and urban design, high rise typology, and cultural institutions.

Master of Architecture with Advanced Standing

Candidates who hold a B.A. or B.S. in Architecture (a pre-professional program from an NAAB recognized school from the U.S) or international student holding a professional degree from outside the U.S.; and who have completed the equivalent of the first year's required courses may qualify for up to one year of advanced standing in the professional degree program. Admission with Advanced Standing may allow the candidate to complete the Master of Architecture degree in as few as two years (four semesters), depending on prior preparation. Candidates may be asked to provide additional evidence on their previous coursework, including projects and course syllabi, to determine eligibility for Advanced Standing. Candidates will be notified upon admission as to their acceptance of Advanced Standing. International students with a Bachelor of Architecture degree (or equivalent) who wish to pursue a NAAB accredited program to be eligible for licensure in the United States should apply to the Master of Architecture with Advanced Standing.

Curriculum and Admission Requirements

The Master of Architecture professional degree program requires a Bachelor's degree in any discipline from an accredited university.

For holders of a bachelors degree outside of the field of architecture, who satisfy the prerequisites for admission, the course of study will be three years (six semesters) in length and 102 credit hours. For candidates who hold a B.A. or B.S. in Architecture (a pre-professional program from an NAAB recognized school if from the U.S.) or international students with a Bachelor of Architecture degree (or equivalent), who satisfy the prerequisites for admission, the course of study may be reduced to a minimum of two years (four semesters) in length and a minimum of 60 credit hours, as required of graduate students by the University, and based on the number of credits received for Advanced Standing. Candidates will be notified of their program requirements at the time of admission. The total number of credit hours, which will be required for graduation, will be established by each student's individual program of study.

To be admitted without conditions to the professional degree program, an applicant is required to possess the following:

1. an understanding of basic systems and analytical procedures, including mechanics, heat transfer, light and sound, as demonstrated through the successful completion of college level physics course equivalent to IIT's PHYS 212;
2. an understanding of basic mathematical principles and analytical procedures, including algebra, geometry, and trigonometry, as demonstrated through the successful completion of college-level mathematics equivalent to IIT's MATH 122;
3. a basic ability to produce freehand drawings of architectural forms and spaces, as demonstrated by the successful completion of one college-level drawing course or by portfolio submissions;
4. a basic understanding of design, as demonstrated by the successful completion of one college-level design course or by portfolio submissions; an equivalent of 20 credit hours of liberal arts and humanities.

Candidates admitted with deficiencies in any of these prerequisites must fulfill them before matriculation. These prerequisite courses do not apply to program credit hours. Applicants must have a college grade point average of 3.0/4.0.

Degree Requirements

As required by the University, graduate students must maintain a 3.0, or 'B', grade point average in their program of study. The College of Architecture also requires this as part of the Master of Architecture degree requirements. Within the College, particular emphasis is placed on the studio as the forum where aspects of the curriculum are synthesized. Candidates must pass each studio course before continuing to the next studio in the sequence. Students may receive a single 'C' in a studio, if maintaining the required 'B' average. However, if a student receives a second 'C' in studio coursework, they will be subject to dismissal from the program. Students may remediate this situation by repeating the coursework and achieving a higher letter grade, or enrolling in a remedial studio. The additional credits required for the additional studio cannot be counted toward their program of study.

In addition to the curricular requirements for the degree, there are several milestones that have been integrated throughout the coursework to ensure a student's successful completion and comprehension of the concepts and material. Each student's progress will be evaluated by an independent panel of faculty prior to their continuation, and eventual completion, of the program.

M.Arch. Curriculum

1st Year

Fall		Credits
ARCH 505	Ecology, Sustainability, and Site	3
ARCH 500	History of Architectural Ideas I	3
ARCH 506	Visual Training Digital Media	3
ARCH 541	Methodology, Material, Technique	6
Total Hours		**15**

1st Year

Spring		Credits
ARCH 485	Intuitive Structures	3
ARCH 501	History of Architectural Ideas II	3
ARCH 507	Visual Training Material Exploration	2
ARCH 508	Digital Applications in Design	3
ARCH 542	Materiality Projects	6
Total Hours		**17**

2nd Year

Fall		Credits
ARCH 403	Building Systems I	3
ARCH 431/432	Visual Training Elective	3
ARCH 486	Structural Design II	3
ARCH 502	Adv. Topics in History and Theory Elective	3
ARCH 543	Structurally Determinant Project	6
Total Hours		**18**

2nd Year

Spring		Credits
ARCH 404	Building Systems II	3
ARCH 503	Adv. Topics in History and Theory II	3
ARCH 509	Topics in Advanced Technology	3
ARCH 565	Project Mgmt. and Construction Administration	3
ARCH 544	Comprehensive Building Project Elective	6
Total Hours		**18**

3rd Year

Fall		Credits
ARCH 520	Principles of Urban Planning and Design	3
ARCH 523	Master's Project Preparation	3
ARCH 545	Community Based Building Project Elective	6
ARCH 561/62/63	Professional Practice Elective	3
Elective		3
Total Hours		**18**

3rd Year

Spring		Credits
ARCH 560	Integrated Building Delivery Practice	3
ARCH 593	Master's Project	6
Elective	Architecture Related	3
Elective	Architecture Related	3
Total Hours		**15**

Total Credit Hours **102**

There are a wide variety of electives available not only in the College of Architecture, but also in IIT's Armour College, Institute of Design, and the Stuart School of Business. If the student has previously taken courses that duplicate curriculum requirements, appropriate electives may be substituted. English language courses required for international students do not apply to program credit hours. Master of Architecture students wishing to accomplish a Masters Thesis as part of the post-professional Master of Science in Architecture program may petition for dual enrollment.

Master of Science in Architecture

The one-year program, two or three semesters in duration, typically lasts a full calendar year. The program is open to applicants holding accredited Bachelor of Architecture (B.Arch.) degrees as first professional degrees from NAAB-accredited institutions. The Master of Science in Architecture program offers advanced architectural study that builds upon knowledge acquired from the Bachelor of Architecture degree; it combines courses and in-depth research concerning a specific area of concentration. The program pursues a high level of architectural research, analysis and synthesis through thesis work in design, structures, systems, digital media and other topics. Areas of faculty excellence in the thesis program include:

(a) High-rise and long-span design;

(b) Environmentally conscious design;

(c) Advanced information systems;

(d) Innovative design methodologies and architecture;

(e) Advanced programming issues in housing, airport design, and other topics;

(f) Critical and theoretical assessments pertaining to construction and the built environment; and

(g) Advanced critical analysis and history/theory.

Specialization in Sustainable New Cities

Candidates interested in the area of Sustainable New Cities may pursue a formal specialization within the Master of Science in Architecture program. Focusing upon the critical issue of global sustainability, this specialization strives to address the urban challenges of accelerating global demand for energy and the design of completely new sustainable cities. Elective courses are selected from a variety of interdepartmental course offerings related to the area of Sustainable New Cities.

Admission and Curriculum Requirements

Candidates for the post-professional Master of Science in Architecture must hold an accredited Bachelor of Architecture (B.Arch) or Master of Architecture (M.Arch) as a professional degree from an NAAB accredited institution if earned within the U.S. International applicants must hold a Bachelor of Architecture or Master of Architecture degre or equivalent and be eligible for licensure in their home country.

In addition to the standard requirements for graduate admission, a personal interview with the director of the degree program is highly recommended. The program of study includes a minimum of 32 credit hours, of which at least eight are in ARCH 591 (Research and Thesis). Students entering the post-professional degree program should develop a detailed outline of their thesis project for approval by the director of thesis programs and their thesis advisor. The program of study for each student is developed individually with the thesis advisor. Study begins with investigation and analysis for the thesis under the direction of the advisor. By the second semester, a thesis committee of three faculty members oversees the work being produced. Students are required to take advanced courses related to their specialized areas of interest.

The final semester of study concludes the entire thesis project in writing, analysis, programming, and design. Thesis studies should offer the graduate a higher level of professionalism, significantly evolving one's career and the ability to make special contributions to the field.

Master of Science in Architecture Curriculum

Fall		Credits
ARCH 588	Thesis Preparation Seminar	3
ARCH 590	Research and Analysis	6
Elective		3
Elective		3
Total Hours		**15**

Spring		Credits
ARCH 589	Pre-Thesis Seminar	3
ARCH 591	Research and Thesis	6
Elective		3
Elective		3
Total Hours		**15**

Summer/Fall		Credits
ARCH 591	Research and Thesis	2
Total Hours		**2**

Total Credit Hours **32**

Master of Integrated Building Delivery–Post-Professional Degree

The Master of Integrated Building Delivery program focuses upon providing comprehensive delivery strategies to promote a quality built environment. The program will educate architects to more actively participate in, guide, and/or undertake the full range of entrepreneurial and innovative activities comprising design, develop and build initiatives. Architecture has generally involved the conceptual basis of project initiation as well as the documentation and management of implementing methodology. Some architects, in response to the broad definition of the profession, must have the abilities and leadership skills to empower the individual toward a position of competency and responsibility in the broader and complex processes of design and construction. The Master of Integrated Building Delivery program aims to provide this knowledge and skill set to those who have already assimilated, or are in the process of acquiring, the more traditional scope of an architectural education. The program is interdisciplinary by design and each course will be taught by an expert in the particular field of study. It is therefore encouraged that electives be pursued from allied colleges within the University including Stuart School of Business, Chicago-Kent College of Law, and Armour College of Engineering. The Master of Integrated Building Delivery is a post-professional degree program and may be completed in as few as two semesters.

Admission and Curriculum Requirements

Candidates for the post-professional degree program must hold an accredited Bachelor of Architecure (B.Arch) or Master of Architecture (M.Arch) as a professional degree from an NAAB accredited institution if earned within the U.S. International aplicants must hold a professional Bachelor of Architecture or Master of Architecture degree or equivalent and be eligible for licensure in their home country.

The Master of Integrated Building Delivery program of study requires a minimum of 30 credit hours. The program is course based with the opportunity for independent investigation in the Comprehensive Development Project and the Project Sector Studies. In order to allow working professionals to attend, courses will be scheduled for evening and weekend hours. The Comprehensive Development Project or Practicum provides two options for the acquisition and assimilation of the breadth of knowledge required to bring projects to fruition. The Comprehensive Development Project is a capstone effort which will demonstrate project concept, planning resolution, land acquisition strategies, estimating, scheduling, financial pro-forma, and value capture intents. The Practicum entails employment at a vetted office, engaged in the actual process of project assembly.

M.IBD Curriculum

Fall		Credits
ARCH 560	Integrated Building Delivery	3
ARCH 561	Entrepreneurship and Innovation in Arch	3
ARCH 562	Planning Law & Land Development Policies	3
ARCH 563	Real Estate Financial Fundamentals	3
Elective		3
Total Hours		**15**

Spring		Credits
ARCH 564	Comprehensive Development Project/Practicum	6
ARCH 565	Project Management & Construction Contract Administration	3
ARCH 566	Project Sector Studies/Case Studies	3
Elective		3
Total Hours		**15**

Total Credit Hours **30**

Master of Landscape Architecture

More than ever, the world needs more informed, more innovative, and more critically involved landscape architects. Globally, the complex urbanization of populations and strain on the environment and natural resources continues to escalate. Locally, the organization, reclamation, and understanding of our cities require the vitality, imagination, managerial sophistication, and compelling design vision of the landscape architect. Among the design professions, landscape architects are assuming leadership roles in transforming conditions of crisis to promise, neglect to value, banality to poetry. The Program of Landscape Architecture at IIT is driven by these needs and aspirations.

Chicago is the active synthesis of the urban and the natural. Geographically it is positioned in dramatic poise within the Great Lakes Basin, where twenty per cent of the world's fresh water supply is not only a natural resource but an economic catalyst in the development of the city. Historically, Chicago is the birthplace of the only genuine American landscape aesthetic - the Prairie School Landscape. It also enjoys the foresight of a world class park system sponsored by the 1893 Columbian Exposition, as well as the world renowned Chicago Botanical Garden. Furthermore, the city itself has publicly embraced an action oriented campaign in current landscape revitalization and environmental goals - Millennium Park, the Boulevards Park System, Chicago Green Roof and Sustainability Initiatives, to name but a few. Locally, the IIT campus offers an invigorating combination of pioneering early modern landmarks to study in and learn from.

Grounded in the tradition of design excellence, technical expertise, and acute visual judgment established by Mies van der Rohe within IIT's College of Architecture, the landscape architecture program is also inspired by the legacy of Alfred Caldwell, the long-term instructor of landscape design at IIT and a frequent collaborator of Frank Lloyd Wright and Mies van der Rohe. Like his mentor, the great prairie landscape architect Jens Jensen, Caldwell's search for the "spirit of the native landscape" was driven by an attention to craft, a hands-on bootstrap energy, and a deep understanding of the plants, construction materials, and environmental needs of the Midwestern landscape. The program's philosophy strives to embrace these timeless ethics while critically incorporating contemporary scientific, ecological, cultural, technical, and artistic influences.

The need to provide constructive, conscientious, and aesthetically compelling environments has never been more prescient. IIT students learn in an unsurpassed setting, utilizing enviable natural and urban resources with world renowned faculty and colleagues similarly inspired and oriented around these responsibilities and challenges. We invite you to join us in being an instrumental part of this program.

Candidates for the Master of Landscape Architecture program must hold a bachelor's degree from an accredited university in any discipline.

To be admitted without conditions to the Master of Landscape Architecture program, an applicant is required to have prior coursework in the following: Freehand Drawing, Biology, and Geology. Candidates will be notified upon admission as to their exact program of study, depending on their prior preparation.

The Master of Landscape Architecture underwent an initial review for accreditation by the Landscape Architectural Accreditation Board (LAAB). Acreditation status wil be confirmed by Fall 2010.

Master of Landscape Architecture Curriculum

1st Year Fall		Credits
LA 501	Nature of Ecology	3
LA 525	Representing and Modeling the Landscape	3
LA 541	Studio I: Dynamics and Processes of Places	6
LA 565	Ecology and Materials Workshop I: Plants and Planning	3
Total Hours		**15**

1st Year Spring		Credits
LA 502	Landscape Architectural History: From Antiquity to Olmsted	3
LA 526	Digital Media	3
LA 542	Studio II: Site and City	6
LA 566	Ecology and Materials Workshop II: Earthworks and Infrastructures	3
Total Hours		**15**

2nd Year Fall		Credits
LA 514	Landscape Architecture Consultants	3
LA 527	Advanced Modeling and Fabrication	3
LA 543	Studio III: Comprehensive Landscape Design	6
LA 567	Ecology and Materials Workshop III: Horticulture and Design	3
Total Hours		**15**

2nd Year Spring		Credits
LA 503	Advanced Contemporary Theory: Case Studies	3
LA 515	Firms, Parks, Developers	3
LA 544	Studio IV: Site, City, and Region	6
LA 583	Ecology and Materials Workshop IV: Manufacturing the Urban Environment	3
Total Hours		**15**

3rd Year Fall		Credits
LA 516	Historic Landscape Preservation	3
LA 545	Studio V: Advanced Landscape Design Investigations	6
Elective	Related to Landscape Research	3
Elective	Related To Architecture	3
Total Hours		**15**

3rd Year Sping		Credits
LA 546	Studio VI: Advanced Landscape Design Investigations	6
Elective	Landscape Architecture Elective	3
Elective	Related to Landscape Research	3
Elective	Related to Architecture	3
Total Hours		**15**

Total Credit Hours	**90**

Electives

Media: GIS, Flash, Animation, Parametric (Revit)
History and Theory: Specific designers, periods, themes
Urban Planning: Current CRP courses
Research: As per individual student and faculty interests

Doctor of Philosophy in Architecture

The Doctor of Philosophy in Architecture (Ph.D.) program is for those advanced graduate students who plan to pursue careers in the academic and research fields and/or in the area of advanced professional practice within the domain of architecture. The rigor of study required for the Ph.D. degree extends the discipline of advanced research and design beyond the master degree and is oriented toward professional applications and academic scholarship.

The program requires a comprehensive knowledge of architecture, a deep understanding of its accomplishments and developments, and critical inquiry that extends its frontiers.

The program combines course-work and research, culminating in a Ph. D. dissertation of extensive and independent, original investigation which could also lead to a design development. The research in some cases may be an extension of work done in the preparation of a Master of Architecture degree in the College of Architecture. Each student's program of study will include seminars, specialized and elective course-work, research and design as preparation for the dissertation.

Admission Requirements

An applicant to the doctoral program must hold a professional Master of Architecture degree (M. Arch.) from an NAAB accredited U.S. university or the equivalent. Candidates who have not completed the required professional M.Arch. degree may apply for either the Master of Architecture or the Master of Science in Architecture program at IIT to fulfill that requirement, as a non-terminal program of studies preparatory for the doctoral program.

The applicant should meet all entrance requirements of lIT's Graduate College, plus a minimum cumulative grade point average of 3.5 on a 4.0 scale; a TOEFL score of at least 550; and at least three letters of recommendation, from immediate supervising professors. The applicant should also submit a statement of purpose indicating a subject of study or research work and should provide a portfolio demonstrating the qualities of his or her accomplishments and expertise.

Degree Requirements

The program requires a minimum of 58 credit hours usually completed in three-and-a-half to four years beyond the M.Arch. degree, which will include a minimum of 26 credit hours of course-work. The majority of the course-work will be selected from the curriculum within the College of Architecture, though students are encouraged to have their research find connections to other doctoral programs at the university.

Upon completion of the first academic year, the candidate will be required to pass a Qualifying Examination before he or she will officially be admitted to Ph.D. candidacy. At the end of the program, the candidate will take a final examination which will consist of an oral presentation and defense of the dissertation. Current areas of study include high-rise and long-span buildings, technology applications, energy conscious design, emerging urbanisms, housing, history/theory, and advanced computer applications. Work for the Ph.D. must be completed within six years after admission to doctoral candidacy.

Course Descriptions

Numbers in parentheses after course descriptions indicate weekly class/lecture hours and lab hours, and total credit hours for the course, respectively.

Architecture

ARCH 403, 404
Building Systems I,II
Design of building mechanical, electrical, plumbing, fire protection, lighting, low voltage, and other systems with an emphasis on the understanding of how these systems integrate with the architecture.
(3-0-3; 3-0-3)

ARCH 413
Architectural Practice
Lectures and practical problems dealing with specifications, specification writing, administration of construction, contracts, building law and professional practice.
(3-0-3)

ARCH 421, 422
Energy Conscious Design I, II
The application of energy conservation methods and renewable energy sources, such as wind power and passive solar systems, will be examined in the development of building energy budgets for a variety of building types. ARCH 421 is a prerequisite for ARCH 422.
(3-0-3;3-0-3)

ARCH 426
Computer-Aided Design in Practice
This course reviews drafting, modeling and rendering computer hardware and software used in the practice of architectural design. Design and management issues are explored with the extensive use of PC CAD systems.
(2-1-3)

ARCH 427
Digital Architecture Media II
A review of 3-D modeling concepts, computer-aided rendering concepts, and methods in the development of architectural design. Extensive use of PC CAD software is expected. Prerequisite: ARCH 426 or consent of instructor.
(3-0-3)

ARCH 428
3-D Animations in CAD Presentations
Review 3-D modeling concepts for animation, preparing camera movements, lighting conditions, special effects, and the digital editing of animation sequences. Extensive use of PC animation and editing software. Prerequisites: ARCH 427 or ARCH 508.
(1-4-3)

ARCH 429
Dgital Form Generation
Review programming in CAD systems; programming basics in AutoCAD, extensive creation of 2-D and 3-D objects, data interrogation, manipulation, and extraction, and 2-D and 3-D parametric- and rule-based design. Investigation of form creation, based on mathematical relationships and random generation. Prerequisite: ARCH 427 or ARCH 508.
(1-3-3)

ARCH 430
Networked Technologies
Study of the relationship between the built environment and networked technologies. Students will learn principals of designing for networked digital space, ways of augmenting physical space through digital technologies, and how networks and web based communication have transformed the practice of architecture and our daily lives. Prerequisite: ARCH 427 or ARCH 508.
(1-2-3)

ARCH 431, 432
Visual Training Elective I, II
These courses focus on the development of visual acuity through the investigation of various media including sculpture, collage or free-hand drawing, digital prototyping, exhibition design, digital media production, and architectural lighting. A variety of courses within this topic will be offered in order to provide both diversity as an elective course and the opportunity for students to pursue individual curricular paths.
(0-2-3;0-2-3)

ARCH 454
Contemporary Chicago Architecture: Case Studies
Contemporary architecture and urban design projects in Chicago present an invaluable opportunity to learn about some of the most advanced applications in practice today. By examining significant projects currently under way, this course will investigate project execution, design concepts and the various forces affecting projects' definitions and results. Close scrutiny of all the components and personnel will give a better understanding of the complex synergies, advanced technologies, and adept project teams necessary for successful innovative architecture and urban planning.
(3-0-3)

ARCH 467
Advanced Materials Workshop
This course provides students with a hands-on experience with the architectural craft of metals as it applies to models and prototypes. Industrial metal working processes are experienced during a field trip. At the conclusion of the class the student creates an original project.
(1-4-3)

ARCH 468
Drawing from Travel
A studio drawing course for the development of perceptual and technical skills critical to drawing in the field. Emphasis on the freehand travel sketch and its capacity to evoke both the physicality and character of a place. Production of a comprehensive drawn record of travels of a journal/sketchbook is required. Various media will be explored. Requisite: Semester Abroad Program.
(0-6-3)

ARCH 469
Urban Design in Europe
This seminar course will explore current notions of urbanism as observed in the built environment of European cities. Projects and discussions will complement the design work undertaken in the architecture design studio. Assignments will focus on documentation and analysis of the systems, organizations, policies and rituals of habitation. Requisite: Semester Abroad Program.
(3-0-3)

ARCH 470
Image City: Mediation of Space
This seminar surveys the interaction between media and the city from the 19th century to the present. A history of the technological innovations of the past 200 years as part of the development of the contemporary city. No account of contemporary urban issues can be considered complete without taking into account the role played in our lives by the media. Accordingly, every space we encounter or create has to be considered "mediated."
(3-0-3)

ARCH 473
Conflict & Time
This seminar employs comparative studies of other arts, in particular cinema, to illuminate architectural esthetics and the creative process.
(3-0-3)

ARCH 474
Production/Design
This seminar examines aspects of design in motion pictures. The premise underlying the course is that the act of perception constitutes an act of design; we produce and design the world we perceive. This becomes particularly evident through analysis of the artificially constructed, illusory reality of films.
(3-0-3)

ARCH 475
Spatial Stories
This course will examine the spatial story as it appears in diverse media: short fiction, films, everyday discourse, the media, architecture, etc. The coursework will consist of reading and writing assignments, as well as the viewing of films and other visual artifacts. The course has two goals to offer students: to improve their study and communication skills and to examine the social, cultural and historical aspects of spatial practices such as architecture.
(3-0-3)

ARCH 485
Intuitive Structures
The fundamentals of structures will be investigated at an intuitive level. Students will be exposed to the principles and concepts of statics, tension, compression, bending, shear, and torsion through dynamic modeling. Simple structural systems including trusses, frames, and flexible cables will be analyzed to examine load paths and deflection. Structural systems will also be considered in how they relate to building typologies and construction materials.
(3-0-3)

ARCH 486
Structural Engineering
Further elaboration on concepts of structural integration in the design process. The content of this course is an overlapping collection of methods and knowledge that influences the decision making process, in particular for assigning structural functions to architectural elements. An in-depth investigation of both the calculation of internal forces and moments resulting from realistic loading conditions and the resulting sizing of steel, timber, and concrete structural members.
(3-0-3)

ARCH 488
Long-Span and Special Structures
Introduction of structural systems for long spans and special structures. The structural behavior will be discussed and the required strength and stiffness will be evaluated. Individual projects will be assigned to students to be presented at the end of the course.
(3-0-3)

ARCH 489
Structural Systems for Tall Buildings and Long-Span Structures
This course reviews the historical development of the interaction of structure with architecture and explores future trends and directions. The suitability of different materials and systems will be studied, with emphasis placed on efficiency.
(3-0-3)

ARCH 495
Technology as Design
Since the development of cast iron as a viable construction material in the mid-1800s, there has been a path of architecture exploring open-ended possibilities of technology. Integrated within the culture, this determination to use the technology of one's time as the creative generator of a new evolving architecture is the thesis of this course.
(3-0-3)

ARCH 497
Special Projects
These special topic electives are offered on a rotating basis and allow students to focus on individual areas of interest. Topics have included furniture design, structural steel design, reinforced concrete design, structural wood design, the history of Chicago modernism, and historic preservation.
(Credit: Variable)

ARCH 500
History of Architectural Ideas I
A comprehensive and critical reading of architectural ideas and built form from classical times until the late 19th-century. With a focus on primary readings and building documentation, the course surveys the embodiment of ideas within the panorama of changing styles, techniques, and attitudes, highlighting the critical debates of each epoch. It places an emphasis on the great complexity of social, political, intellectual, and material forces affecting architectural thought and design. Critical reading and writing skills will be emphasized.
(3-0-3)

ARCH 501
History of Architectural Ideas II
The second half of a two-semester survey, this course is devoted to the history of architectural ideas from 1900 to the present. It begins with the first attempts to formulate a modern architecture in the early years of the twentieth century; continues to address the consolidation of modern architecture between the world wars, postwar extensions of modernism, and the critiques posed by various forms of postmodernism; and concludes with a range of contemporary issues, including globalization, digital technology, and sustainability. With a focus on primary readings and building documentation, the course is intended to survey the embodiment of ideas within the panorama of changing styles, techniques, and attitudes. It places an emphasis on the great complexity of social, political, intellectual, and technological forces affecting design. Critical reading and writing skills will be emphasized.
(3-0-3)

ARCH 502,503
Advanced Topics in History and Theory Elective I, II
Intended to build on the knowledge and abilities gained in the foundational architectural history and theory courses. These seminars focus on advanced topics in history, theory, and criticism. Students select from varying and diverse topics such as: urbanism, sustainability, design methodology, aesthetics, ethics and law, history of technology, and architecture in relation to other arts. Seminars may also offer intense focus on particular architects, periods, regions, or movements. Critical reading and writing skills will be emphasized. In addition, the advanced seminars will teach research skills, will expect the students to formulate and pursue original research topics, and will expect oral presentations of these projects. These abilities will be evaluated through in-class presentations and research papers.
(3-0-3;3-0-3)

ARCH 505
Ecology, Sustainability, Site
Students will develop a sensitivity to the environment in which architecture is created. Emphasis will be placed on an in-depth exposure to the integration of natural features of site, sustainable components of both natural and man-made systems, and the synergy of ecological design.
(3-0-3)

ARCH 506
Visual Training Digital Media
The development of visual acuity through the analysis of aesthetic expression. Exercises in visual perception and aesthetic judgment transition from traditionally hand manipulated to digital media. Critical inquiry of media; isolation and analysis; interdependence and integration of sensuous qualities. Exercises include the study of proportion and rhythm, texture and color, mass and space. Topics of inquiry vary.
(3-1-2)

ARCH 507
Visual Training Material Exploration
The course will include the research and study of the architectural surface and the integration into built form. Faade systems, enclosure assemblies and related materials will be investigated as part of a graphic study as well as full scale built application. The relationships of materials and construction methods will be evaluated with respect to architectural expression and performance.
(3-1-2)

ARCH 508
Digital Applications in Design
An exploration of digital design applications and techniques as a means of architectural information expression. This class will look at the elaborate toolset of digital design in architectural practice with a primary focus on Building Information Modeling. Utilizing BIM and Parametric modeling, the students will generate 3D buildling models for use in design, energy analysis, estimating, scheduling and renderings. BIM provides continuous immediate feedback for the student and through utilizing this model the student will also be aware of this new efficient way for multiple disciplines to work collaboratively.
(3-1-2)

ARCH 509
Advanced Technology
This research seminar examines advances in the technologies that affect the practice of architecture. The course examines leading technologies, processes and applications and their role in building design and production. The course will navigate the broad and varied materials related to advanced technologies in architecture by focusing on specific applications for specific projects. Students may select between varying and diverse topics offered by the faculty that may include: building envelopes, architectural materials, building and environmental systems, advanced structural design, energy and sustainability, architectural acoustics and lighting, fabrication, and computer-aided design technologies.
(3-0-3)

ARCH 520
Principles of Urban Planning and Design
An immersion in the history, discourse and culture of cities in the modern era, with an emphasis on Chicago, and focused on the needs and influences surrounding urban growth, development, and culture. Readings, lectures, case studies, film screenings, field trips, and discussions will provide a basic set of conceptual and theoretical resources for understanding the origins and development of cities. Although the more disciplinary concerns of urban design will be covered in the concurrent ARCH 545 studio, this course will also develop a context for understanding the role of design in shaping the urban environment.
(3-0-3)

ARCH 523
Masters Project Preparation Research, Analysis and Programming
Identification and development of the proposal for the Masters Project. Development of the Project will include a comprehensive listing of all necessary program elements, research, analysis and selection of site, and a statement of design parameters, project objectives or similar project characteristics. Projects will be selected from eight areas of focus: sustainable cities, building delivery practices, community based planning, research/history/theory, research/advanced technologies, housing and urban design, high rise typology, and cultural institutions.
(3-0-3)

ARCH 541
Methodology, Material, Technique
This studio is an introduction to design methods and fundamental architectural principles through exercises focusing on methodology, materiality and architectural language. Exercises sequentially become more complex in relation to the physical properties and qualities of spatial complexity, function and materiality. Emphasis on exploration and technique within the design process.
(0-12-6)

ARCH 542
Materiality Projects
This studio explores the relationship between spatial definition and material properties, construction methods, and structural typologies through a series of sequential architectural projects. It introduces architecture as an integrated practice that unifies intention, material, construction, and spatial definitions. Emphasis is placed on materials and applications as fundamental components of architecture. The course promotes a collaborative approach as essential to research and professional practice.
(0-12-6)

ARCH 543
Structurally Determinant Project
This studio introduces the premise that design, and the pursuit of architecture, is enhanced by the integration of and sensitivity to the essential determinates of the composition. Sensitivity will be developed through a single architectural project and accompanying structural component, that will focus on the way in which site, function and material choice coalesce into a structurally determinant form.
(0-12-6)

ARCH 544
Comprehensive Building Project Elective
Design of a single building demonstrating the synthesis of ecological planning, programming, and code and zoning analysis, structure, and building systems. Students will be able to select from varied studio topics.
(0-12-6)

ARCH 545
Community Based Building Project Elective
In this studio students will be introduced to the discipline and techniques of urban design through the understanding of temporality, density, infrastructure, and public space through the scale of a singular building within the context of a larger built environment. Focus will be given to the direct interaction with public agencies, community groups, developers, and community development corporations. The public orientation of the studios will provide an understanding of urban design as a fundamentally future-oriented practice, with an expanded potential for engagement in the socio-political. Students will be able to select from varied studio topics.
(0-12-6)

ARCH 551, 552
Design of Energy-Efficient Buildings I, II
Design criteria for achieving human performance goals in energy-efficient buildings, criteria for the exterior/interior environment, and criteria for architectural, mechanical, electrical and building system components. Building upon the fall course, various energy-conserving strategies shall be evaluated for achieving cost effective, energy efficient design of a specific building type.
(3-0-3;3-0-3)

ARCH 553, 554
High Rise Building Technology
The course consists of presentations by specialists in the various technologies of high-rise building, including planning, financing, code reinforcement, materials, architecture, engineering, project management, construction, building management services, safety and maintenance.
(3-0-3;3-0-3)

ARCH 560
Integrated Building Delivery Practice
The course will address the use of Advanced Virtual Building Models as a design and management tool. A strong component of the course will be to establish a firm recognition of the integrated building process which underlies the benefits of the digital media. The course integrates the subject matter presented throughout the Integrated Building Practice curriculum.
(3-0-3)

ARCH 561
Entrepreneurship and Innovation in Architecture
Teaches future architects the practical aspects of entrepreneurial small business management, to develop a comprehensive opportunity assessment and to develop the skills necessary to improve the odds of success. Also covers small organization and group behavior, performance, leadership and motivation in small business settings and focuses on the owner/manager as the principle success factor in the context of a small organization. Emphasis is placed on the organization, business, and evolving models of practice are covered.
(3-0-3)

ARCH 562
Planning Law and Land Development Policy
The course will promote a knowledge of and sensitivity to the major points of government regulations and development issues, and an understanding of the entrepreneurial climate which engages and promotes the practice of Architecture. A recognition of the myriad forces promoting the development initiatives, and the range of restraining and/or guiding ordinances shaping the process, will inform the course of study.
(3-0-3)

ARCH 563
Real Estate Financial Fundamentals
Cognizant that economic concerns are generally the drivers of, the constraints to, and the effecting variable of most built projects, the architect must understand the issue as one of the prime determinates in all building projects. The course will give the architectural student the background to assume leadership in the valuation of the design and its ultimate construction.
(3-0-3)

ARCH 565
Project Management and Construction Administration
The course endeavors to make clear the activities, roles, and responsibilities of the broad range of building project team participants. Coursework will allow the student to understand the knowledge base brought by each member of the project team, and allow a better integration of individual and team efforts toward a project's realization.
(3-0-3)

ARCH 566
Entrepreneurial Design: Sector Studies/Case Studies
This course will be an independent study format. Each student will work independently to research a project option, or building type, and document the particular attributes of that case study which require specialized address. Case studies might be a particular business niche, such as land sub-divisions, condo conversions, change of use conversions, or build to suit options. The studies might pursue particular building types, or social initiatives, historic restoration strategies, or even unique construction typologies.
(3-0-3)

ARCH 588
Thesis Preparation Seminar
Seminars are conducted on thesis development and preparation with emphasis placed on language, the written form, thesis manual requirements, drawing and model presentation, and the oral presentation for jury examination.
(3-0-3)

ARCH 589
Pre-Thesis Seminar
An introduction to the architecture faculty through a discussion of current issues and future directions of the profession. These concerns are then related to the specific student's interest and the specialized experience of the faculty. A Thesis Advisory Committee, with a thesis chairman and two additional faculty members, is assigned to each thesis student. Together, they identify the thesis project, program, its scope and objective and, most important, budget time for each phase.
(3-0-3)

ARCH 590
Specialized Research and Thesis Development
Each thesis project must demonstrate an intellectual objective and an in-depth study that will contribute to the practice of architecture. The formulated problem should combine a theoretical search with the practical considerations of the profession. Research methods are identified that will provide the resources and information necessary for the design process. Post-occupancy building evaluations of similar problems are used to analyze technical assumptions, functional response, and social reaction.
(Credit: Variable)

ARCH 591, 592
Research and Thesis
A thesis project is developed in depth by the student under the direction of the adviser and an advisory committee of other architecture faculty and/or professional members. Specialized research and design within a wide range of architectural problems include site selection, consideration of architectural context and environmental impacts, development of user function and space programs, and architectural planning and design. Aesthetic and visual aspects and the intellectual foundations of the problem are carefully considered, as well as the technical aspects in the selection and integration of structural and environmental systems. After final acceptance of the presentation materials by the advisory committee, the text, reductions of the drawings, and model photographs are bound together in a hard-cover volume, which is deposited in the GRC and the university's library.
(Credit: Variable; minimum total eight semester hours)

ARCH 593
Masters Project
The Masters Project is the culmination of the Master of Architecture curriculum as the synthesis of architectural study into an independent project. The Project is, most commonly, the design of a building or in-depth research about specific aspects of the built environment. Specialized research and design within a wide range of architectural problems include site selection, consideration of architectural context and environmental impacts, development of user function and space programs, and architectural planning and design. Aesthetic and visual aspects and the intellectual foundations of the problem are carefully considered, as well as the technical aspects in the selection and integration of structural and environmental systems. Successful Masters Project proposals will be grouped into Areas of Focus studios. After final acceptance of a student's presentation materials by the faculty advisor and the Area of Focus teaching faculty, the text, reductions of the drawings, and model photographs are bound together, which are deposited in the GRC and the University's library.
(0-12-6)

ARCH 597
Special Topics
These special topic electives are offered on a rotating basis and allow students to focus on individual areas of interest. Topics have included furniture design, structural steel design, reinforced concrete design, structural wood design, the history of Chicago modernism, and historic preservation.
(Credit: Variable)

ARCH 601
Doctoral Methodology Pro-Seminar
This course provides a foundation for doctoral students to the diversity of research paradigms in architecture. The first component is an introduction to the philosophy of knowledge with an emphasis on architecture. The second component entails a critical review and evaluation of diverse research methodologies in current doctoral architectural research, with substantial information on research methodologies not covered in undergraduate and graduate education. Students will write a series of papers that critically review the course readings and discussions.
(3-0-3)

City and Regional Planning

CRP 425, 426
History and Architecture of Cities
Selected topics in the history and development of human settlements. Examination of the forces affecting city development in history. These courses are taught as seminars and meet for one three-hour period per week.
(3-0-3;3-0-3)

CRP 465
The Ecological Basis for Planning
The role of natural systems in meeting human needs. Climate, geology, landforms, soils, vegetation and animal populations as the bases of agricultural and industrial technologies. Competing demands on air, water and land. Limiting factors.
(3-0-3)

CRP 519
Principles of City Planning I
This course explores the problems of housing from the scale of the single dwelling to larger residential buildings. Examination of the internal functions of a housing unit, the relationship of one unit to another, and of the overall structure and development of settlement units.
(3-0-3)

CRP 520
Principles of City Planning II/ Urban Dsign
This course explores principles of urban design. Applications will make analyses of urban issues such as the integration of urban elements into an organic whole, the town center, the interrelationship of built forms to open spaces and the varying components of the urban fiber. Prerequisite: CRP 519.
(3-0-3)

CRP 521
Advanced Planning I, II
Advanced work in city and regional planning. Analysis. Structure. Clarification of principle and idea in planning. Varied problems. Prerequisite: CRP 519, CRP 520, or consent of instructor.
(Credit: Variable)

CRP 531
Advanced Housing
Advanced work. The dwelling and groups of dwellings as a planning and architectural problem. Variations. Site. Clarification of principle in working out specific solutions. Prerequisites: CRP 519, CRP 520 or consent of instructor.
(3-0-3)

CRP 532
Community Development
Advanced work. Consideration of entire community and its elements. Density. Spatial development. Varied problems to clarify principles. Prerequisites: CRP 519, CRP 520 or consent of instructor.
(3-0-3)

Landscape Architecture

LA 443
Forests, Preserves, Parks, and Urbanscapes
The growing need for these public site types in America in the 1800s gave rise to the landscape architecture profession. More necessary now than ever, the planning and design approach to these sites is undergoing major change. In this course students will investigate the historical and contemporary environmental and cultural relationships of the American landscape. Themes include landscape use and ecological change, regional and national landscapes, the roles of the National Park Service, state and county park and forest systems, and municipal green spaces. Case studies and analyses of specific sites.
(3-0-3)

LA 501
Nature of Ecology
An historical, theoretical, and scientific account of nature's role in the humanities and sciences as they relate to design. Emphasis is placed on the relationships between natural systems and the fitness of a landscape, the site and the organism, open and closed systems, causation and constraints, sustainability, and the complex interplay between humans and the designed environment.
(3-0-3)

LA 502
Landscape Architectural History: From Antiquity to Olmsted
The chronological history of landscape design from antiquity to Olmsted, with an emphasis on garden and park typologies.
(3-0-3)

LA 503
Advanced Contemporary Theory: Case Studies
The study of 20th century landscape design with an emphasis on the Prairie School, modernism, organicism, and contemporary trends. The course is split between lectures and in-depth case studies of significant landscapes from the Chicago region and beyond. Collecting information from the study projects' authors and weekend site visits will lead to models and representations (drawings, videos, etc.) that reveal otherwise latent aspects of each study project's organization, perceptual character, appearance, and performance.
(3-0-3)

LA 514
Landscape Architecture Consultants
The roles and expertise of, and the relationships between, consultants commonly used during site planning, design, engineering, construction, and post-construction maintenance. Co-requisite: LA 543.
(3-0-3)

LA 515
Firms, Parks, Developers
The players who orchestrate and manage landscapes, including planners, landscape architects, trusts, governmental agencies, and developers; and their economic, professional, political, and socio-cultural concerns and responsibilities.
(3-0-3)

LA 516
Historic Landscape Preservation
Survey of historic landscape preservation theory, method, and practice, and their relationship to environmental and cultural considerations.
(3-0-3)

LA 525
Representing and Modeling the Landscape
Using hand drawing and physical modeling to explore and interrogate landscape processes. Techniques and methods to explore, develop and envision ideas particular to landscape design. Mapping, time, movement, body in space, line, contour, texture, flows of materials (hydro, litho, aero), plant communities. Corequisite: Concurrent enrollment in LA 541.
(3-0-3)

LA 526
Digital Media
Using digital tools to clarify, conceptualize, represent, and communicate the forces and flows within designed and engineered environments. A fluidity between critical, visual, and quantifiable digital techniques will be cultivated and will ground the management of information across software platforms. Focus on Photoshop, Illustrator, and AutoCAD. Prerequisite: LA 525 or equivalent.
(3-0-3)

LA 527
Advanced Modeling and Fabrication
Students learn advanced digital fabrication and modeling techniques necessary to understand complex three-dimensional surfaces, objects, and space, as well as dynamic processes. Modeling, rendering, scripting, and animation skills are used to conduct, generate, and communicate research. Prerequisite: LA 526 or equivalent.
(3-0-3)

LA 541
Studio I: Dynamics and Processes of Place
Understanding the fundamental relationships of dynamic natural processes, with an emphasis on representing time, movement, space, light, natural rhythms, shifting boundaries and enclosures, and the physical materials of landscape. Within a natural setting, students use varied tools (including the body) to measure and record landscape specific phenomena and conditions such as erosion, entropy, edges, and movement through dynamic spaces. Students develop insightful and appropriately precise methods of modeling and representing these phenomena.
(0-12-6)

LA 542
Studio II: Site and City
Understanding constructed sites, programs, and the infrastructure, and the landscape architect's role in organizing them. Built and natural context's as well as extant and proposed programs are analyzed and speculated upon to develop conceptual frameworks. Exercises emphasize the integration of these concerns into the design of a variety of spaces, places, and apparatus.
(0-12-6)

LA 543
Studio III: Comprehensie Landscape Design
The integration of local ecologies, projected use, and the performance of ephemeral, semi-permanent, and permanent site interventions, into cohesive and resilient design proposals for varied urban sites. Introduction to a wide range of site-specific and common design standards, including ADA and Barrier-Free regulations.
(0-12-6)

LA 544
Studio IV: Site, City, and Region
Developing and testing approaches to the planning and design of largescale, multi-program environments. Special concern given to the implications of site-specific proposals to offsite, regional areas and the integration of economic, environmental, and social criteria as part of the design process.
(0-12-6)

LA 545
Studio V: Advanced Landscape Design Investigations
Integration of large-scale site, programming, planting design, ecology of site, and other design elements and problems into a cohesive design solution. Practical application of the relationship among sites, drawings, and the making of landscape architectural projects. The semester is sequenced: site analysis; programming decisions; site modeling; development of design; representation and defense of design graphically (plan and elevation views), model, and materials and planting list, and design of environments which are responsive to human need and expressive of physiographic conditions. An introduction to the methods and use of GIS (Geographic Information System).
(0-12-6)

LA 546
Studio VI: Advanced Landscape Design Investigations
Critical synthesis of complex environmental, regulatory, and cultural conditions with multi-faceted programs, demanding a mastery of knowledge, skill, and technique, appropriate for a graduating student.
(0-12-6)

LA 565
Ecology and Materials Workshop I: Plants and Planting
The plants of the Western Great Lakes Basin, emphasizing both prominent native and commercially available species. Understanding and identifying species as found within typical plant communities. Familiarization with plant physiography as determined by climate, geology, topography, hydrology, soils, wildlife, and disturbances (natural and anthropogenic).
(2-2-3)

LA 566
Ecology and Materials Workshop II: Earthworks and Infrastructures
The qualities and characteristics of soft and hard landscape materials with emphasis on a quantitative and interrelated understanding of landform (grading) and drainage design. Covers the influence of climate, geology, soils, hydrology, and disturbances on the design of a site's constituent elements, including pathways and roads, infrastructure, plantings, and stormwater management strategy.
(2-2-3)

LA 567
Ecology and Materials Workshop III: Horticulture and Design
Advanced understanding of horticulture as a technical science. The relationship between ecological research and a designed and engineered site, and applications thereof.
(2-2-3)

LA 568
Ecology and Materials Workshop IV: Manufacturing the Urban Environment
Techniques and technologies to analyze, construct, remediate and/or restore urban sites, including those that have been subjected to complex human disturbances, such as landfills and brownfields. Includes special needs construction practices such as structured soils, phytoremediation, green roofs and rooftop gardens. Overview of relevant site-specific codes and environmentally oriented building programs such as LEED.
(2-2-3)

Undergraduate Course Prerequisites

The courses described below and at right are undergraduate courses, some or all of which are prerequisites to graduate study in the College of Architecture. Applicants to the Colleges degree programs must demonstrate proficiency in the undergraduate-level courses or their equivalents listed in the Admission Requirements and individual program descriptions sections.

MATH 119
Geometry for Architects
Basic analytic geometry in two and three dimensions; trigonometry. Equations of lines, circles and conic sections; resolution of triangles; polar coordinates. Equations of planes, lines, quadratic surfaces. Applications.
(3-0-3)

MATH 122
Introduction to Mathematics II
Basic concept of calculus of a single variable; limits, derivatives, integrals, applications.
(3-0-3)

PHYS 211, 212
Basic Physics I, II
Intended to give students in the liberal arts, architecture and design an understanding of the basic principles of physics and an appreciation of how physics influences contemporary society. Prerequisites: Math 122.
(3-0-3;3-0-3)

Department of Biological, Chemical and Physical Sciences

Life Sciences Building
3101 S. Dearborn St.
Chicago, IL 60616
312.567.3480
www.iit.edu/csl/bcps

Associate Chairs:
Grant Bunker, Physics
Benjamin C. Stark, Biology
Rong Wang, Chemistry

The Department of Biological, Chemical and Physical Sciences offers B.S., M.S. and Ph.D. degrees in the fields of chemistry, biology, physics, and molecular biochemistry and biophysics. Within the department, there are many opportunities for interdisciplinary education and research experiences; students in any of the disciplines have easy access to the expertise that the full faculty brings. In addition, the department offers several professional masters degrees and related certificate programs for part-time students, both on campus and through distance learning.

Degrees Offered

Master of Biology with specialization in:
- Biochemistry
- Biotechnology
- Cell and Molecular Biology
- Microbiology

Master of Science in Biology with specialization in:
- Biochemistry
- Biotechnology
- Cell and Molecular Biology
- Microbiology

Master of Science in Molecular Biochemistry and Biophysics
Master of Chemistry
Master of Chemistry in Analytical Chemistry
Master of Chemistry in Materials and Chemical Synthesis
Master of Science in Chemistry
Master of Health Physics
Master of Science in Physics
Doctor of Philosophy in Biology
Doctor of Philosophy in Chemistry
Doctor of Philosophy in Molecular Biochemistry and Biophysics
Doctor of Philosophy in Physics

Certificate Programs

Analytical Method Development
Analytical Spectroscopy
Characterization of Inorganic and Organic Materials
Chromatography
Radiological Physics
Synthesis and Characterization of Inorganic Materials
Synthesis and Characterization of Organic Materials

Research Centers

Center for Synchrotron Radiation Research and Instrumentation
Center for Accelerator and Particle Physics
Center for the Molecular Study of Soft and Condensed Matter

Research Facilities

The department has state-of-the-art computer and laboratory equipment and conducts research in the areas of biochemistry, biotechnology, cell and molecular biology, microbiology, molecular biophysics and biochemistry; analytical chemistry, inorganic chemistry, solid-state and materials chemistry, organic chemistry, polymer chemistry, surface chemistry, physical chemistry and theoretical chemistry; and elementary particle physics, accelerator and plasma physics, condensed-matter physics, biological physics, x-ray optics, x-ray imaging and quantum theory. The department constructs and operates facilities for x-ray scattering, spectroscopy and imaging at the Advanced Photon Source at Argonne National Laboratory. Additional research facilities include on-campus x-ray diffraction facilities, thin-film growth facilities, a high-field nuclear magnetic resonance facility, state-of-the-art inorganic-, organic- and polymer synthesis and characterization laboratories, Fourier transform infrared spectrometers, atomic force microscope, mass spectrometers, and facilities for high-pressure liquid chromatography and gas chromatography. Laboratories for experimental research in biophysics, low-temperature, solid-state physics and particle physics are active. Collaborative programs are carried on with Fermi National Accelerator Laboratory, Argonne National Laboratory, and the Advanced Photon Source. The department hosts the Center for Accelerator and Particle Physics (CAPP), the Center for Synchrotron Radiation Research and Instrumentation (CSRRI), and the Center for the Molecular Study of Soft and Condensed Matter.

Faculty

Biology Faculty

Tanya I. Bekyarova, Senior Lecturer, and Director of the Master of Biology Program. M.S., University of Plovdiv; Ph.D., Illinois Institute of Technology. Macromolecular structure. Biochemistry, Cell and Molecular Biology.

Douglas J. Cork, Professor. B.S., M.S., Ph.D., University of Arizona. Biotechnology and bioremediation, microbial metabolism of xenobiotics, informatics. Microbiology, Biotechnology.

Michael Cummings, Research Professor. B.S., St. Mary's University; Ph.D., Northwestern University. Research on human chromosome organization and the development of innovative methods for teaching biology. Cell and Molecular Biology.

Mitchell Dushay, Assistant Professor. B.S., Brown University; Ph.D., Brandeis University. Drosophila genetics, immunology, eukaryotic transcription. Cell and Molecular Biology.

Andrew Howard, Associate Professor and Director of the Health Physics Program. B.A., Pomona College; Ph.D., University of California, San Diego. Structure and function of immune system proteins, macromolecular crystallography. Biochemistry, Molecular Biochemistry and Biophysics.

Thomas C. Irving, Professor and Director of the Biophysics Collaborative Access Team. B.Sc., M.Sc., Ph.D., University of Guelph (Canada). Structure and biophysics of macromolecular systems, muscle structure and physiology, synchrotron radiation instrumentation. Biochemistry, Molecular Biochemistry and Biophysics.

John Kilbane II, Research Professor. B.S., Ohio State University; Ph.D., Tufts University. Biological removal of sulfur from petroleum; genetic engineering of bacteria for bioremediation. Microbiology, Biotechnology.

David L. McCormick, Professor, and Senior Vice President and Director of the IIT Research Institute. B.A., Middlebury College; Ph.D., New York University. Preclinical development of drugs for the prevention and therapy of cancer. Cell and Molecular Biology.

Rajendra Mehta, Professor and Assistant Vice President of the IIT Research Institute. B.Sc., Gujurat Univeristy; Ph.D., University of Nebraska-Lincoln. Efficacy and mechanism of action of chemopreventive agents in experimental carcinogenesis of breast, colon, lung and prostate. Cell and Molecular Biology.

Nick Menhart, Associate Professor. B.Sc., Ph.D., University of Waterloo (Canada). Spectroscopic techniques for the study of multi-domain proteins. Biochemistry, Molecular Biochemistry and Biophysics.

Genoveva Murillo, Research Assistant Professor. B.S., M.S., Ph.D., University of Illinois, Chicago. Nutritional modulation of carcinogenesis of the colon and other tissues; cancer chemoprevention. Cell and Molecular Biology.

Joseph Orgel, Assistant Professor. B.Sc., Ph.D., University of Stirling (Scotland). Study of fundamental structural biochemistry problems that have direct links to the understanding and treatment of disease, primarily of the extracellular matrix of mammals. Biochemistry, Molecular Biochemistry and Biophysics.

Kathryn M. Spink, Senior Lecturer. B.S., Michigan Technological University; Ph.D., Michigan State University. Molecular genetics of mammalian viruses. Cell and Molecular Biology, Microbiology.

Benjamin C. Stark, Professor and Associate Chair of the Department. B.S., University of Michigan; M.Ph., Ph.D., Yale University. Biochemistry and molecular biology of bacterial respiration, fermentation, bioremediation. Microbiology, Biotechnology, Cell and Molecular Biology.

Cynthia Stewart, Research Assistant Professor. B.S., University of Delaware; PhD, Rutgers University. High pressure and other nonthermal technologies, such as cold pasteurization or commercial sterilization processes, to improve the quality and safety of foods. Microbiology, Biotechnology.

Jason Wan, Research Professor. B.S., Hunan University; M.S., Northeast Agricultural University; Ph.D., Deakin University (Australia). Molecular mechanisms of tracking foodborne pathogens, non-thermal food processing technologies. Microbiology, Biotechnology.

Dale A. Webster, Emeritus and Research Professor. B.S., University of Michigan; Ph.D., University of California, Berkeley. Biochemistry and molecular biology of bacterial respiration, biotechnology and bioremediation. Biochemistry, Microbiology, Biotechnology.

Jialing Xiang, Associate Professor. M.D., Xuzhou Medical College; Ph.D. University of Alabama, Birmingham. Molecular mechanisms of cancer and cancer gene therapy. Cell and Molecular Biology.

Chunbo Zhang, Assistant Professor. B.S., Ningbo Univeristy; Ph.D., University of Manitoba (Canada). Use of molecular genetics, biophysics, immunohistochemistry, pharmacology, and behavior to study olfactory transduction in the mouse and in fish. Cell and Molecular Biology.

Wei Zhang, Assistant Professor. B.S., Huazhong Agricultural University; Ph.D., Pennsylvania State University. Molecular detection, genotyping, epidemiology, virulence and pathogenesis of foodborne bacteria. Microbiology, Biotechnology.

Chemistry Faculty

Sandra Whaley Bishnoi, Assistant Professor. B.S., Ph.D., University of Texas at Austin. Synthesis and analysis of inorganic nanoparticles, biomolecular recognition, surface science, analytical chemistry, nanobiotechnology, development of nanoparticle delivery methods, and surface enhanced Raman scattering.

Brant Cage, Assistant Professor. B.S., University of West Florida; Ph.D., Florida State University. Synthesis and biophysical applications of magnetic materials, design and building sensitive instrumental techniques to characterize magnetic materials; theoretical analysis of novel materials with superior properties for particular needs, such as magnetic resonance imaging (MRI) enhancement, magnetic refrigeration, and standards for MRI.

Hyun-soon Chong, Associate Professor. B.S., M.S. Kyung Hee University; Ph.D. University of North Texas. Synthetic and mechanistic organic chemistry, macrocyclic chemistry, cancer therapeutics and diagnostics, medicinal chemistry, bioorganic and bioinorganic chemistry, biologically active synthetic and natural products, heterocyclic chemistry, molecular recognition studies, nanobiotechnology.

Walter C. Eisenberg, Emeritus Professor. B.S. University of Toronto (Canada); M.S., Rochester Institute of Technology; Ph.D., University of Buffalo. Organic-, oxidantand single oxygen chemistry, biochemistry, air pollution, polycyclic aromatic hydrocarbon transformation, analytical methods development, professional graduate education.

Robert Filler, Emeritus Professor, Senior Research Fellow. B.S., City College of New York; Ph.D., University of Iowa. Heterocyclic compounds, effects of fluorine in fluorine-containing compounds.

Adam S. Hock, Assistant Professor. B.S., University of Delaware, Ph.D., Massachusettes Institute of Technology. Homogenous and heterogenous inorganic and organometallic synthesis and catalysis; rational and tunable methods for the preparation of light-harvesting and novel electronic materials; structure, bonding, and electronic properties of molecular and extended materials.

Peter Y. Johnson, Professor. B.S., University of Illinois, Urbana-Champaign; Ph.D., Massachusetts Institute of Technology. Syntheses of penicillin related compounds; photochemical and/or transannular reactions.

M. Ishaque Khan, Professor, Associate Dean, College of Science and Letters, and Director of the Materials and Chemical Synthesis Program. Ph.D., Indian Institute of Technology (Kampur, India). Design, synthesis, and property studies of new generation, high performance advanced materials. Current focus is on nanomaterials for applications in chemical sensing, energy storage, and biomedical usage, and nanostructured catalysts doe detection and removal of toxic gases from industrual exhaust and flue gas streams, selective oxidation, (hydrocarbon's transformation into useful industrial feed-stocks), and hydrotreating catalysis.

Peter Lykos, Professor. B.S., Northwestern University; Ph.D., Carnegie Institute of Technology. Physical chemistry, standards for undergraduate chemistry and chemistry curricula, combination theoretical (Hartree Fock) and experimental (synchrotron radiation) determination of correlation energy, semi-empirical methods in quantum chemistry, computer applications in chemistry.

Braja K. Mandal, Professor. B.Sc., University of Calucutta (India); M.Sc., M.Tech., Ph.D., Indian Institute of Technology (India). Polymer science and engineering, electroactive materials, phthalocyanines and porphyrins, solid polymer electrolytes, lithium battery materials.

Diep Nguyen, Industry Professor, Director of the Professional Science Master Program in Analytical Chemistry, Ph.D., McGill University (Canada). Characterization of polymers, industrial applications of polymeric materials, analytical methods development and professional graduate education.

Kenneth Schug, Professor. B.S., Stanford University; Ph.D., University of Southern California. Chemical education, coordination compounds of transition metals emphasizing chemical reactivity of ligands, enhancement programs for K-12 teachers, minority medical students programs, research opportunities for high school students.

Joseph R. Stetter, Research Professor. B.S., Ph.D., State University of New York, Buffalo. Electroanalytical chemistry, environmental analytical chemistry, chemical sensors, detectors, development of new analytical methods.

Aditya K. Unni, Assistant Professor. B.S., Saint Olaf College; Ph.D., the University of Chicago. Synthesis of small molecule natural products with interesting structural characteristics and biological activities. Developing reactions, specifically in asymmetric catalysis, to access high value chemical building blocks for organic synthesis.

Sameer Varma, Research Assistant Professor. B.S., M.S., Indian Institute of Technology; Ph.D., University of Illinois, Urbana-Champaign. Computational chemistry, statistical mechanics, biohpysics, quantum mechanical simulations, molecular mechanics simulations, structural informatics, membrane-protein function, drug design.

Rong Wang, Associate Professor, Associate Chair. B.S., Julin University; Ph.D., University of Tokyo (Japan). Scanning probe microscopy, bioconjugate chemistry, biocompatible materials, method of development for single cell characterization and manipulation, analysis of effects of microenvironments on protein/cell/tissue function and dynamics.

Physics Faculty

Russell Betts, Professor and Dean of the College of Sciences and Letters. B.A., M.A., Oxford University; M.S., University of Pennsylvania; Ph.D., University of Pennsylvania. Nuclear Physics.

Grant Bunker, Professor and Associate Chair. B.A., Evergreen State College; Ph.D., University of Washington. X-ray absorption spectroscopy, biophysics, synchrotron radiation research, computational physics/chemistry.

Ray A. Burnstein, Emeritus and Research Professor. B.S., University of Chicago; M.S., University of Washington; Ph.D., University of Michigan. Experimental elementary particle physics, interactive teaching and technology. Liam Coffey, Associate Professor. B.A., Trinity College (Ireland). Ph.D., University of Chicago. Condensed matter theory.

Thomas Erber, Distinguished Emeritus Professor. B.S., Massachusetts Institute of Technology; M.S., Ph.D., University of Chicago. Electrodynamics, magnetism, fatigue, complex systems.

Laurence Friedman, Senior Lecturer and co-Director of the Health Physics program. B.S., University of Wisconsin; Ph.D. Rensselaer Polytechnic Institute. Health Physics, regulatory affairs.

David Gidalevitz, Assistant Professor of Physics. B.S., Urals Technical University (Russia); Ph.D., Weizmann Institute of Science (Israel). Membrane biophysics, biomaterials, drug delivery, biosensors and biomimetic thin films, and polymer films.

Alan Glodowski, Senior Lecturer of Physics. B.S., University of Wisconsin-Madison; M.S., Creighton University.

Porter W. Johnson, Emeritus Professor. B.S., Case Institute of Technology; M.A., Ph.D., Princeton University. Elementary particle theory, science education.

Daniel Kaplan, Professor and Director of the Center for Accelerator and Particle Physics. B.A., Haverford College; Ph.D., State University of New York, Stony Brook. Experimental high-energy physics, especially symmetry violation and rare decays of hyperons and charm and beauty hadrons, electronics for high-speed triggering and data acquisition.

Gocha Khelashvili, Assistant Research Professor of Physics. B.S., Tblisi State University; M.S., Johns Hopkins University; Ph.D., Illinois Institute of Technology. Medical and Health Physics.

Leon Lederman, Pritzker Professor of Physics, 1988 Nobel Laureate in Physics; Fermilab Director Emeritus. B.A., City College of New York; Ph.D., Columbia University. Experimental elementary particle physics.

Timothy Morrison, Professor, Director of the Center for Synchrotron Radiation Research and Instrumentation. B.A., Western Michigan University; Ph.D., University of Illinois, Urbana-Champaign. Solid-state physics, catalysts, x-ray absorption, x-ray optics.

Howard A. Rubin, Professor Emeritus. B.S., Massachusetts Institute of Technology; Ph.D., University of Maryland. Experimental elementary particle physics.

H. Larry Scott, Professor of Physics. B.S., Purdue University; Ph.D., Purdue University. Theoretical modeling and computer simulation of lipid bilayers and model biological membranes.

Carlo U. Segre, Professor, Associate Dean for Graduate Enrollment, and Associate Director of the Materials Research Collaborative Access Team. B.S. in Physics, B.S. in Chemistry, University of Illinois, Urbana-Champaign; M.S., Ph.D., University of California, San Diego. Experimental condensed-matter physics, superconductivity, x-ray structural studies of complex materials.

Harold N. Spector, Emeritus Professor. B.A., M.S., Ph.D., University of Chicago. Solid-state theory, electronic and optical processes and semi-conducting nanostructures.

Linda Klamp Spentzouris, Associate Professor. B.A., Colorado College; Ph.D., Northwestern University. Accelerator physics.

Zack Sullivan, Assistant Professor. B.A., Physics and Mathematics, Johns Hopkins University; M.S., Physics, University of Illinois at Urbana-Champaign; Ph.D., Physics, University of Illinois at Urbana-Champaign. Theoretical Particle Physics beyond the Standard Model.

Jeff Terry, Assistant Professor. B.S., University of Chicago; Ph.D., Stanford University. Synchroton radiation techniques.

Yagmur Torun, Assistant Professor. B.S., Middle East Technical University; Ph.D., SUNY at Stony Brook. Accelerator and High Energy Physics.

Christopher White, Associate Professor. B.S., University of Illinois, Urbana-Champaign; Ph.D., University of Minnesota. Experimental elementary particle physics.

John Zasadzinski, Professor. B.S., Illinois Benedictine College; Ph.D., Iowa State University. Solid state physics.

Earl Zwicker, Emeritus Professor of Physics. B.S., University of Wisconsin; Ph.D., Illinois Institute of Technology. Physics education.

Admission Requirements

Cumulative undergraduate GPA minimum: 3.0/4.0
TOEFL minimum: 550/213/80*

The Graduate Record Examination (GRE) is required for all applicants. The GRE minimum scores are:

Ph.D.: 1200 (quantitative + verbal),
3.0 (analytical writing)
M.S.: 1000 (quantitative + verbal),
2.5 (analytical writing)
MAS: 1000 (quantitative + verbal),
2.5 (analytical writing)
MCH: 900 (quantitative + verbal),
2.5 (analytical writing)

Applicants to the doctoral program in chemistry are strongly encouraged to submit the subject-area GRE score (Subject No. 27). Applicants to the doctoral program in physics are strongly encouraged, but not required, to take the subject-area GRE exam in physics. Applicants to the doctoral program in molecular biochemistry and biophysics are strongly encouraged to take one of the subject exams in biology, molecular biology, chemistry or physics.

Meeting the minimum GPA and test score requirements does not guarantee admission. Test scores and GPA are just two of several important factors considered.

Applicants to one of the department's programs (Biology, Chemistry, Physics or Molecular Biochemistry and Biophysics) are expected to have a bachelors degree from an accredited institution with a major in that same discipline, or a closely allied major with additional coursework that prepares the student for graduate study in the chosen program. Students who have not completed all required courses may be accepted for general admission and can begin coursework, but must remove any deficiencies before the MCH, MAS, and M.S. comprehensive/Ph.D. qualifying examination.

* Paper-based/computer-based/internet-based test score.

Departmental Graduate Examinations

All full-time students in the M.S. and Ph.D. programs are required to take and pass the written M.S. comprehensive/Ph.D. qualifying examination by the end of their fourth semester of study. Part-time students must pass this examination by a comparable stage of their programs. The examination is offered twice each academic year. A student may sit officially for the examination a maximum of two times. Students passing this examination at the Ph.D. level are judged to be qualified to continue in the Ph.D. program. Students passing at the Master of Science level or above may obtain their masters degree after completing the requirements described in the following sections. All students in the Ph.D. program who have passed the written qualifying examination must take and pass a comprehensive examination before the end of the sixth semester of full-time study. Part-time students must pass this examination by a comparable stage of their programs. This examination consists of a written proposal, an oral presentation and a defense of the proposal before a faculty committee. A student may take this examination a maximum of two times. Students passing this examination may continue with their research and will receive a Ph.D. upon satisfactory completion of all other required courses and general requirements of the Graduate College, a written dissertation and final oral thesis defense.

All students in the professional master degree programs are required to take and pass a comprehensive exam. Students may sit for the exam a limited number of times, depending upon the individual program.

Biology

The department offers graduate programs leading to Master of Biology and to M.S. and Ph.D. degrees in biology, concentrating educational and research activities in the areas of biochemistry, biotechnology, cell and molecular biology, and microbiology. Graduate education in biology is available on either a full- or a part-time basis. Masters degree programs are designed so that they may be completed by part-time students. Doctoral-level courses are usually available either in the evenings. on Saturdays, or on the internet. Each new graduate student is assigned a graduate student advisor and must obtain the approval of the advisor each semester before registering for any graduate classes.

Master of Biology

Minimum 30 credit hours
Comprehensive examination

The Master of Biology is a course-only, professional masters degree program designed for professionals who seek advanced and specialized study in the field without the requirement of a thesis or project.

This program is also available on the Web, and at televised viewing sites throughout the Chicago area. Students should consult www.iit-online.iit.edu for more information.

Students must pass the written comprehensive examination (see Departmental Graduate Examinations) in their respective areas of specialization: biochemistry, cell and molecular biology, or microbiology. Students in biotechnology may choose any of the three examinations. The program consists of a minimum of 30 credit hours of coursework as follows.

Cell and Molecular Biology

BIOL 401 Introductory Biochemistry **AND**
BIOL 402 Metabolic Biochemistry
OR
BIOL 504 Biochemistry Lectures
BIOL 445 Cell Biology
OR
BIOL 544 Molecular Biology of Cells
BIOL 515 Molecular Biology
BIOL 526 Developmental Biology

AND 6-9 hours of approved electives

Microbiology

BIOL 401 Introductory Biochemistry **AND**
BIOL 402 Metabolic Biochemistry
OR
BIOL 504 Biochemistry Lectures
BIOL 445 Cell Biology
OR
BIOL 544 Molecular Biology of Cells
BIOL 515 Molecular Biology
BIOL 542 Advanced Microbiology

AND 6-9 hours of approved electives

Biochemistry

BIOL 401 Introductory Biochemistry **AND**
BIOL 402 Metabolic Biochemistry
OR
BIOL 504 Biochemistry Lectures
BIOL 512 Advanced Biochemistry
BIOL 445 Cell Biology
OR
BIOL 544 Molecular Biology of Cells
BIOL 515 Molecular Biology

AND 6-9 hours of approved electives

Biotechnology

BIOL 401 Introductory Biochemistry **AND**
BIOL 402 Metabolic Biochemistry
OR
BIOL 504 Biochemistry Lectures
BIOL 445 Cell Biology
OR
BIOL 544 Molecular Biology of Cells
BIOL 515 Molecular Biology
BIOL 562 Functional Genomics

AND 6-9 hours of approved electives

Students in each area of specialization also take the following three courses:

CHEM 513 Statistics for Analytical Chemists
COM 423 Communication in the Workplace **OR**
COM 421 Technical Communications **OR**
COM 580 Communicating Sciences
AND
BIOL 511 Project Management **OR**
CHEM 524 Synthesis and Intellectual Property **OR**
INTM 511 Industrial Leadership

Elective courses for the areas of specialization will be chosen in conjunction with the student's advisor.

Master of Science in Biology

Minimum 32 credit hours
Comprehensive examination
Option 1: Thesis
Option 2: Library or Laboratory research project

A Master of Science student must complete 32-34 credit hours of approved graduate work in one of the areas of specialization detailed below. This will include 26-30 credit hours of coursework and one credit hour of BIOL 595 Colloquium. Two options are available to complete the M.S. degree requirements: a thesis option and a nonthesis option.

Students must pass the written M.S. comprehensive examination (see Departmental Graduate Examinations) in their respective areas of specialization: biochemistry, cell and molecular biology, or microbiology. Students in biotechnology may choose any of the three examinations.

Thesis Option

The thesis option is designed for individuals planning careers as experimental biologists, including those who may wish to pursue a Ph.D. This option is available on a competitive basis. Students choosing the thesis option must complete six credit hours of thesis research (BIOL 591). Students must also prepare a written thesis based on laboratory research.

Non-Thesis Option

The non-thesis option is intended as a degree to meet the needs of teachers, science administrators, policy makers in the life sciences, patent attorneys and others.

Students who elect the non-thesis option must complete a library research project in one of the following courses: BIOL 572 (Literature in Biochemistry), BIOL 574 (Literature in Biotechnology), BIOL 576 (Literature in Cell and Molecular Biology), or BIOL 578 (Literature in Microbiology); or a laboratory research project in BIOL 522 (Research Techniques in the Biological Sciences) plus BIOL 597 (special topics).

Master of Science in Biology with specialization in Biochemistry

32 credit hours

Required courses (19 hours)

BIOL 445 Cell Biology
OR
BIOL 544 Molecular Biology of Cells
BIOL 504 Biochemistry Lectures
BIOL 512 Advanced Biochemistry
BIOL 515 Molecular Biology
BIOL 519 Biochemistry Laboratory
BIOL 555 Macromolecular Structure Determination

Additional requirements (7 hours):

BIOL 595 Colloquium
BIOL 591 Research
OR
CHEM 591 Research
OR
BIOL 572 Literature in Biochemistry **AND** one additional elective
OR
BIOL 522 Research Techniques in Biological Sciences
AND
BIOL 597 Special Topics

Elective courses (6 hours)

BIOL 410 Medical Microbiology
BIOL 426 Cancer Biology
BIOL 430 Animal Physiology
BIOL 503 Virology
BIOL 514 Toxicology
BIOL 520 Advanced Biochemistry Laboratory
BIOL 526 Developmental Biology
BIOL 527 Immunology and Immunochemistry
BIOL 533 Laboratory in Cell and Molecular Biology
BIOL 539 Advanced Cell Biology Laboratory
BIOL 542 Advanced Microbiology
BIOL 545 Advanced Cell Biology
BIOL 550 Bioinformatics and Biotechnology
BIOL 562 Functional Genomics

Other requirements are identical to those described previously for all M.S. students in biology. The requirements for admission to this program include one year of physical chemistry in addition to the usual requirements for admission to graduate study in biology.

Master of Science in Biology with specialization in Biotechnology

Minimum 32 credit hours

Required Courses (19 hours minimum)

BIOL 445 Cell Biology
OR
BIOL 544 Molecular Biology of Cells
BIOL 504 Biochemistry Lectures
OR
BIOL 401 Introductory Biochemistry
AND
BIOL 402 Metabolic Biochemistry

BIOL 515 Molecular Biology
BIOL 519 Biochemistry Laboratory
OR
BIOL 533 Laboratory in Cell and Molecular Biology
BIOL 550 Bioinformatics and Biotechnology
BIOL 562 Functional Genomics

Additional requirements (7 hours):

BIOL 595 Colloquium
BIOL 591 Research
OR
BIOL 574 Literature in Biotechnology **AND** one addtional elective
OR
BIOL 522 Research Techniques in Biological Sciences
AND
BIOL 597 Special Topics

Elective courses (6 hours)

BIOL 410 Medical Microbiology
BIOL 426 Cancer Biology
BIOL 430 Animal Physiology
BIOL 503 Virology
BIOL 512 Advanced Biochemistry
BIOL 514 Toxicology
BIOL 520 Advanced Biochemistry Laboratory
BIOL 521 Advanced Micro Genetics Laboratory
BIOL 526 Developmental Biology
BIOL 527 Immunology and Immunochemistry
BIOL 539 Advanced Cell Biology Laboratory
BIOL 542 Advanced Microbiology
BIOL 545 Advanced Cell Biology
BIOL 555 Macromolecular Structure Determination
BIOL 580 Laboratory Rotation in Molecular Biochemistry and Biophysics

Other requirements are identical to those described previously for all M.S. students in biology.

Master of Science in Biology with specialization in Cell and Molecular Biology

Minimum 32 credit hours

Required Courses (19 hours minimum)

BIOL 445 Cell Biology
OR
BIOL 544 Molecular Biology of Cells
BIOL 504 Biochemistry Lectures
OR
BIOL 401 Introductory Biochemistry
AND
BIOL 402 Metabolic Biochemistry

BIOL 515 Molecular Biology
BIOL 526 Developmental Biology
BIOL 533 Laboratory in Cell and Molecular Biology
BIOL 545 Advanced Cell Biology

Additional requirements (7 hours):

BIOL 595 Colloquium
BIOL 591 Research
OR
BIOL 576 Literature in Cell Biology **AND** one additional elective
OR
BIOL 522 Research Techniques in Biological Sciences
AND
BIOL 597 Special Topics

Elective courses (6 hours)

BIOL 410 Medical Microbiology
BIOL 426 Cancer Biology
BIOL 430 Animal Physiology
BIOL 503 Virology
BIOL 512 Advanced Biochemistry
BIOL 514 Toxicology
BIOL 519 Biochemistry Laboratory
BIOL 520 Advanced Biochemistry Laboratory
BIOL 527 Immunology and Immunochemistry
BIOL 539 Advanced Cell Biology Laboratory
BIOL 542 Advanced Microbiology
BIOL 550 Bioinformatics and Biotechnology
BIOL 555 Macromolecular Structure Determination
BIOL 562 Functional Genomics
BIOL 580 Laboratory Rotation in Molecular Biochemistry and Biophysics

Other requirements are identical to those described previously for all M.S. students in biology.

Master of Science in Biology with specialization in Microbiology

Minimum 32 credit hours

Required Courses (22 hours minimum)

BIOL 445 Cell Biology
OR
BIOL 544 Molecular Biology of Cells
BIOL 503 Virology
BIOL 504 Biochemistry Lectures **OR**
BIOL 401 Introductory Biochemistry
AND
BIOL 402 Metabolic Biochemistry

BIOL 515 Molecular Biology
BIOL 519 Biochemistry Laboratory
OR
BIOL 533 Laboratory in Cell and Molecular Biology
BIOL 542 Advanced Microbiology
BIOL 562 Functional Genomics

Additional requirements (7 hours):

BIOL 595 Colloquium
BIOL 591 Research
OR
BIOL 578 Literature in Microbiology **AND** one additional elective
OR
BIOL 522 Research Techniques in Biological Sciences
AND
BIOL 597 Special Topics

Elective courses (3 hours)

BIOL 410 Medical Microbiology
BIOL 426 Cancer Biology
BIOL 430 Animal Physiology
BIOL 512 Advanced Biochemistry
BIOL 514 Toxicology
BIOL 520 Advanced Biochemistry Laboratory
BIOL 521 Advanced Micro Genetics Laboratory
BIOL 526 Developmental Biology
BIOL 527 Immunology and Immunochemistry
BIOL 539 Advanced Cell Biology Laboratory
BIOL 545 Advanced Cell Biology
BIOL 550 Bioinformatics and Biotechnology
BIOL 555 Macromolecular Structure Determination
BIOL 580 Laboratory Rotation in Molecular Biochemistry and Biophysics

Other requirements are identical to those described previously for all M.S. students in biology.

Doctor of Philosophy in Biology

84 credit hours
Written qualifying examination
Comprehensive examination
Dissertation and oral defense

A minimum of 84 credit hours is required for the Ph.D. degree in biology. Students should consult the section Transfer Credits on page 31 for rules on how many credit hours may be transferred from another institution. Completion of an M.S. degree is not normally required for admission to the full-time program for the Ph.D. degree but may be required of part-time students. Students must pass the Ph.D. qualifying examination in their respective areas of specialization: biochemistry, cell and molecular biology, or microbiology (see Departmental Graduation Examinations).

Each student, in addition, will be required to pass a comprehensive examination taken prior to performing the major portion of the dissertation research, and in any event, prior to the sixth semester of study and at least one year before oral defense of the thesis. The final examination for the Ph.D. degree consists of an oral presentation and defense of the dissertation.

The Ph.D. program is tailored to fit the student's background and goals and is subject to approval at the time of filing of the program of study (Form 401). Programs of study may be designed in any of the three areas of concentration. However, all programs of study must include at least 36 credit hours in formal courses (exclusive of BIOL 591 and BIOL 691).

Formal courses must include the core courses listed below:

Core Courses

BIOL 445 Cell Biology
OR
BIOL 544 Molecular Biology of Cells
BIOL 504 Biochemistry Lectures
BIOL 515 Molecular Biology
BIOL 595 Biology Colloquium (4 times)

Elective Courses

BIOL 410 Medical Microbiology
BIOL 414 Genetics for Engineering Sciences
BIOL 426 Cancer Biology
BIOL 430 Animal Physiology
BIOL 503 Virology
BIOL 514 Toxicology
BIOL 519 Biochemistry Laboratory
BIOL 520 Advanced Biochemistry Laboratory
BIOL 521 Advanced Micro Genetics Laboratory
BIOL 526 Developmental Biology
BIOL 527 Immunology and Immunochemistry
BIOL 533 Laboratory in Cell and Molecular Biology
BIOL 539 Advanced Cell Biology Laboratory
BIOL 542 Advanced Microbiology
BIOL 545 Advanced Cell Biology
BIOL 550 Bioinformatics and Biotechnology
BIOL 555 Macromolecular Structure Determination
BIOL 562 Functional Genomics
BIOL 580 Laboratory Rotation in Molecular Biochemistry and Biophysics
BIOL 584 Graduate Seminar in Biology
BIOL 597 Special Topics
PHYS 410 Molecular Biophysics

All research for the dissertation must be carried out under the direct supervision of a faculty research advisor. The faculty research advisor will also act as the candidate's academic advisor. Students must have passed the written qualifying examination before registering for BIOL 691 (Ph.D. Thesis Research). Students may complete all formal course requirements for the Ph.D. degree as either full-time or part-time students.

Molecular Biochemistry and Biophysics (MBB)

The department offers interdisciplinary programs leading to M.S. and Ph.D. degrees in molecular biochemistry and biophysics. New advances in our understanding of biological function can be expected from a synthesis of molecular genetics, biochemistry and insights gained from molecular structural information. Individuals with a quantitative, physical approach will be best placed to be innovators in the field. MBB programs complement more traditional graduate programs in biology, chemistry and physics by offering an integrated, molecular-based approach to understanding biological problems, taking insights from all three disciplines.

A major focus of the program is on biophysical approaches to determining the structure of macromolecules and macromolecular assemblies. Faculty advisors are chosen from any of the participating departmental faculty regardless of their affiliation to a particular discipline; a particular strength of the participating faculty is in exploiting synchrotron x-ray sources for biological structural studies. MBB students will have access to state-of-the-art x-ray facilities at the nearby Advanced Photon Source, currently one of the most intense x-ray sources in the world.

Master of Science in Molecular Biochemistry and Biophysics

32 credit hours
Comprehensive examination
Option 1: Thesis
Option 2: Library or Laboratory research project

A master's student must complete 32 credit hours of approved graduate work, including a core of 22 credit hours, 1 hour of BIOL 595 (Colloquium), 3 credit hours of approved electives, and 6 credit hours of research toward the thesis (BIOL, CHEM, or PHYS 591); or BIOL 572 (Literature in Biochemistry) and one additional elective, or BIOL 522 (Research Techniques in the Biological Sciences), and 3 credit hours of BIOL 597 (Special Topics).

Required Courses (22 hours)

BIOL 445 Cell Biology
OR
BIOL 544 Molecular Biology of Cells
BIOL 504 Biochemistry Lectures
BIOL 515 Molecular Biology
BIOL 519 Biochemistry Laboratory
OR
BIOL 533 Laboratory in Cell and Molecular Biology
BIOL 555 Macromolecular Structure Determination
PHYS 410 Biophysics
BIOL 512 Advanced Biochemistry Lectures

Additional requirements (7 hours):

BIOL 595 Colloquium
BIOL 591 Research
OR
CHEM 591 Research
OR
PHYS 591 Research
OR
BIOL 572 Literature in Biochemistry **AND** one addtional elective
OR
BIOL 522 Research Techniques in Biological Sciences
AND
BIOL 597 Special Topics

Elective courses (3 hours)

BIOL 410 Medical Microbiology
BIOL 426 Cancer Biology
BIOL 430 Animal Physiology
BIOL 503 Virology
BIOL 514 Toxicology
BIOL 520 Advanced Biochemistry Laboratory
BIOL 526 Developmental Biology
BIOL 527 Immunology and Immunochemistry
BIOL 539 Advanced Cell Biology Laboratory
BIOL 542 Advanced Microbiology
BIOL 545 Advanced Cell Biology
BIOL 550 Bioinformatics and Biotechnology
BIOL 562 Functional Genomics
BIOL 580 Laboratory Rotation in Molecular Biochemistry and Biophysics

The elective is chosen in consultation with an academic advisor. Research for the dissertation must be carried out under the direct supervision of a participating faculty member; the faculty reseach advisor also acts as the candidate's academic advisor.

Thesis Option

The thesis option is designed for individuals planning careers as experimental biologists, including those who may wish to pursue a Ph.D. This option is available on a competitive basis. Students choosing the thesis option must complete six credit hours of thesis research (BIOL, CHEM, or PHYS 591). Students must also prepare a written thesis based on laboratory research.

Non-Thesis Option

The non-thesis option is intended as a degree to meet the needs of teachers, science administrators, policy makers in the life sciences, patent attorneys and others.
Students who elect the non-thesis option must complete a library research project in BIOL 572 (Literature in Biochemistry), or a laboratory based research project in BIOL 522 (Research Techniques in the Biological Sciences) plus BIOL 597 (Special Topics).

Doctor of Philosophy in Molecular Biochemistry and Biophysics

84 credit hours
Written qualifying examination
Comprehensive examination
Dissertation and oral defense

A minimum of 84 credit hours of instruction is required for the MBB Ph.D. Students should consult the section Transfer Credits on page 31 for rules on how many credit hours may be transferred from another institution. Completion of an M.S. degree is not normally required for admission to the Ph.D. program. Students must complete 21 credit hours of core courses and at least five additional courses from the list of electives.

Each graduate student must take and pass the written Ph.D. qualifying examination in order to enter into candidacy for the doctorate. Each student, in addition, will be required to pass a comprehensive examination taken prior to performing the major portion of the dissertation research, and in any event, prior to the sixth semester of study and at least one year before oral defense of the thesis. The final examination for the Ph.D. degree consists of an oral presentation and defense of the dissertation.

The Ph.D. program is tailored to fit the students background and goals and is subject to approval at the time of filing of the program of study (Form 401). The program of study must include at least 36 credt hours in formal courses (exclusive of BIOL 591 and BIOL 691).

All students will be required to take the following courses, or have equivalent background:

Core courses

BIOL 445 Cell Biology
OR
BIOL 544 Molecular Biology of Cells
BIOL 504 Biochemistry Lectures
BIOL 512 Advanced Biochemistry
BIOL 515 Molecular Biology
BIOL 555 Macromolecular Structure Determination
BIOL 584 Graduate Seminar in Biology
BIOL 595 Biology Colloquium
PHYS 410 Molecular Biophysics

MBB students, in consultation with their academic advisor, choose the remainder of their formal coursework from the following list of elective courses:

Elective Courses

BIOL 410 Medical Microbiology
BIOL 414 Genetics for Engineering Sciences
BIOL 426 Cancer Biology
BIOL 430 Animal Physiology
BIOL 503 Virology
BIOL 514 Toxicology
BIOL 519 Biochemistry Laboratory
BIOL 520 Advanced Biochemistry Laboratory
BIOL 521 Advanced Micro Genetics Laboratory
BIOL 526 Developmental Biology
BIOL 527 Immunology and Immunochemistry
BIOL 533 Laboratory in Cell and Molecular Biology
BIOL 539 Advanced Cell Biology Laboratory
BIOL 542 Advanced Microbiology
BIOL 545 Advanced Cell Biology
BIOL 550 Bioinformatics and Biotechnology
BIOL 562 Functional Genomics
BIOL 580 Laboratory Rotation in Molecular Biochemistry and Biophysics
BIOL 597 Special Topics

Other courses may be prescribed by the advisor/thesis committee according to the student's individual needs for the program of study. All research for the dissertation must be carried out under the direct supervision of a faculty research advisor who will also act as the candidate's academic advisor.

Chemistry

The department offers graduate programs leading to M.S. and Ph.D. degrees in chemistry. Each student's program is planned individually to meet individual needs, interests and capabilities. In addition, the department offers two professional master's programs designed for the parttime student and available through distance learning. The aim of these programs is to develop chemists who are able to think creatively and critically. In recognition of the value of teaching experience in strengthening an individual's understanding of his or her field of study and as an aid in making career decisions, the department requires all full-time Ph.D. students to participate in instructional activities.

Each new graduate student is assigned a graduate student advisor and must obtain the approval of the advisor each semester before registering for any graduate classes.

Master of Chemistry in Analytical Chemistry

32 credit hours
Comprehensive examination

The professional master's program in analytical chemistry is a part-time program for working chemists seeking to strengthen their understanding of analytical chemistry. The specific goal of the program is to provide the student with a broad and in-depth understanding of state-of-the-art analytical techniques with a firm grounding in separation science, spectroscopy, method development and sample preparation. In addition, students acquire professional skills in effective communication, statistics, and business principles. Candidates must possess a bachelor's degree (ideally in science or engineering) with at least one semester of calculus, one semester of calculus-based physical chemistry, one semester of analytical chemistry, and two semesters of organic chemistry. Candidates' advisors assist them in determining if any further prerequisites are necessary. A final comprehensive exam is required for graduation. This program is also available via the internet. Students should consult www.iit.edu/csl/bcps for more information.

Core Courses

CHEM 500 Advanced Analytical Chemistry
CHEM 505 Spectroscopic Methods I
CHEM 506 Sampling and Sample Preparation
CHEM 508 Analytical Methods Development
CHEM 509 Physical Methods of Characterization
CHEM 512 Spectroscopic Methods II
CHEM 513 Statistics for Analytical Chemists
CHEM 515 Fundamentals of Separation Science
CHEM 516 Applied Liquid and Gas Chromatography

Choose one of the following three courses:

CHEM 542 Polymer Characterization and Analysis
CHEM 543 Analytical Chemistry in Pharmaceutical Laboratories
CHEM 544 Colloids and Colloid Analysis

Choose two of the following courses:

CHEM 511 Project Management
COM 423 Communication in the Workplace
OR
COM 580 Communicating Science
INTM 511 Industrial Leadership

Master of Chemistry

32 credit hours
Comprehensive examination

A minimum of 32 credit hours is required for the Master of Chemistry degree. Students seeking the Master of Chemistry degree must pass the oral comprehensive examination in their area of specialization (as determined by the student's academic advisor) by the end of their 4th semester in the master of chemistry degree program. The comprehensive examinations are given in the following areas:

- Analytical Chemistry
- Biochemistry
- Inorganic Chemistry
- Organic Chemistry
- Polymer Chemistry
- Physical chemistry

The Master of Chemistry program is tailored to fit the student's background and goal and is subject to approval at the time of filing of the Program of Study (Form 401). Programs of study must include the following core courses.

CHEM 584 Graduate Seminar
CHEM 585 Colloquium in Chemistry

The required coursework includes a minimum of four core courses chosen from the following core courses (credit hours in parentheses). Each of the four core courses must be chosen from six different chemistry disciplines including analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, physical chemistry, and polymer chemistry.

CHEM 455 Advanced Organic Chemistry
OR
CHEM 530 Organic Reactions and Mechanisms
CHEM 500 Advanced Analytical Chemistry
OR
CHEM 505 Spectroscopic Methods I
CHEM 520 Advanced Inorganic Chemistry
OR
CHEM 521 Structural Inorganic and Solid-State Chemistry
CHEM 550 Quantum Chemistry
CHEM 470 Introduction to Polymer Chemistry
OR
CHEM 535 Polymer Synthesis
BIOL 504 Biochemistry Lectures

There are 15 course credit hours total required by the chemistry program. The graduate college requires 20 course credit hours. The remainder of the program of study will be chosen in consultation with the student's advisor. Students can choose any of the elective courses in consultation with their academic advisor.

Master of Chemistry in Materials and Chemical Synthesis

31 credit hours
Comprehensive examination

The professional masters program in materials and chemical synthesis is a part-time program designed for scientists who wish to broaden their background in synthesis and characterization of materials and chemical systems. The program combines modern materials design and synthesis strategies with innovative characterization techniques, computational & simulation methods, environmental regulations, project management, technical communication, and intellectual property management. The specific goals of the program of study are to provide the student with a broad and in-depth understanding of state-of the-art in materials and chemical synthesis and characterization techniques; to learn how to design and manage projects; to sharpen intellectual property management techniques; to learn how to operate under regulatory constraints; and to improve communication skills. Candidates must have a bachelors degree (ideally in science or engineering), with at least two semesters of organic chemistry and two semesters of calculus. Academic advisor assists students in determining whether any prerequisites are necessary. A final comprehensive examination is required for graduation. This program is also available on the Web, and at televised viewing sites throughout the Chicago area. Students should consult www.iit.edu/csl/bcps for more information.

Core Courses

CHEM 454 Computer Modeling and Simulations
CHEM 505 Spectroscopic Methods I
CHEM 511 Project Management
CHEM 521 Structural, Inorganic, and Materials Chemistry
CHEM 522 Efficient Synthesis and Catalytic Chemistry
CHEM 524 Synthesis and Intellectual Property Management
CHEM 530 Organic Reaction Mechanisms
CHEM 535 Polymer Synthesis
CHEM 539 Introduction to Pharmaceutical Chemistry
ENVE 545 Environmental Regulations and Risk Assessment
COM 423 Communication in the Workplace

Master of Science in Chemistry

32 credit hours
Comprehensive examination
Thesis and oral defense

A minimum of 32 credit hours is required for the M.S. in chemistry. Students seeking the Master of Science degree must pass the written comprehensive examination in their area of specialization (as determined by the student's thesis advisor) by the end of their fourth semester in the M.S. program. The comprehensive examinations are given in the following areas:

- Analytical Chemistry
- Biochemistry
- Inorganic Chemistry
- Organic Chemistry
- Physical Chemistry
- Polymer Chemistry

The student must also write a thesis based on original research and defend it before his or her M.S. thesis committee. The thesis and oral defense should be completed before the end of their 3rd year.

The M.S. program is tailored to fit the student's background and goals and is subject to approval at the time of filing of the Program of Study (Form 401).

Required Courses

CHEM 584 Graduate Seminar
CHEM 585 Colloquium in Chemistry

The required coursework includes a minimum of four core courses chosen from the following courses (credit hours in parentheses). Each of the four core courses must be chosen from six different chemistry disciplines including analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, physical chemistry, and polymer chemistry.

CHEM 455 Advanced Organic Chemistry
OR
CHEM 530 Organic Reactions and Mechanisms
CHEM 500 Advanced Analytical Chemistry
OR
CHEM 505 Spectroscopic Methods
CHEM 520 Advanced Inorganic Chemistry
OR
CHEM 521 Structural Inorganic and Solid-State Chemistry
CHEM 550 Quantum Chemistry
CHEM 470 Introduction to Polymer Chemistry
OR
CHEM 535 Polymer Synthesis
BIOL 504 Biochemistry Lectures

There are 15 course credit hours total required by the chemistry program. The graduate college requires 20 course credit hours. The remainder of the program of study will be chosen in consultation with the student's advisor. Students can choose any of the elective courses in consultation with their academic advisor.

Doctor of Philosophy in Chemistry

84 credit hours
Written qualifying examination
Comprehensive examination
Dissertation and oral defense

A minimum of 84 credit hours is required for the Ph.D. in chemistry students who have received an M.S. degree from another university may petition for transfer of up to 32 credit hours applicable toward the Ph.D. degree. Students must pass the Ph.D. qualifying examination in their area of specialization (as determined by the student's thesis advisor) by the end of their fourth semester in the Ph.D. program. Ph.D. qualifying examinations are given in the following areas:

- Analytical Chemistry
- Biochemistry
- Inorganic Chemistry
- Organic Chemistry
- Physical Chemistry
- Polymer Chemistry

The comprehensive examination will be taken and passed on each students research progress and thesis proposal. A student must write a thesis proposal and present a research seminar on his or her thesis progress before their Ph.D. thesis committee. Students must pass the comprehensive exam before the end of their 3rd year. The final phase in the Ph.D. degree program is the successful oral defense of the dissertation and submission of a Ph.D. dissertation approved by the academic advisor and the thesis committee.

The Ph.D. program is tailored to fit the student's background and goal and is subject to approval at the time of filing of the Program of Study (Form 401).

Required Courses

CHEM 550 Chemical Bonding
CHEM 584 Graduate Seminar
CHEM 585 Colloquium in Chemistry
CHEM 684 Graduate Seminar
CHEM 685 Colloquium in Chemistry

The required coursework includes a minimum of four core courses chosen from the following courses. Each of the four core courses must be chosen from six different chemistry disciplines including analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, physical chemistry and polymer chemistry.

CHEM 455 Advanced Organic Chemistry
OR
CHEM 530 Organic Reaction Mechanisms
CHEM 500 Advanced Analytical Chemistry
OR
CHEM 505 Spectroscopic Methods I
CHEM 518 Electrochemical Methods
CHEM 520 Advanced Inorganic Chemistry
OR
CHEM 521 Structural Inorganic and Solid-State Chemistry
CHEM 550 Quantum Chemistry
CHEM 470 Introduction to Polymer Chemistry
OR
CHEM 535 Polymer Synthesis
BIOL 504 Biochemistry Lectures

Physics

The department offers programs leading to M.S. and Ph.D. degrees in physics. The M.S. degree is not a prerequisite for the Ph.D. The department also offers a professional masters program in health physics designed for the part-time student and available through distance learning. Research is organized into small groups of faculty members, post-doctoral associates, graduate students and undergraduate students working on closely related projects. The principal active areas include experimental and theoretical condensed matter physics, experimental and theoretical elementary particle physics, synchrotron radiation physics, accelerator physics, structural and computational biophysics, magnetism and electrodynamics. Classes are generally small and informal, and thesis research is carried out in close collaboration with the faculty adviser.

In recognition of the value of teaching experience in strengthening an individuals understanding of his or her field of study and as an aid in making career decisions, the department requires full-time students to participate in instructional activities. Each new graduate student is assigned a graduate student adviser and must obtain the approval of the adviser each semester before registering for any graduate classes.

Master of Health Physics

Minimum 30 credit hours
Comprehensive examination

Designed primarily for working professional health physicists in government, medicine, research and industry, this program combines technical depth with the interdisciplinary viewpoints of leadership, management and communications. The degree can be completed in four semesters and two summer sessions of part-time study. Applicants must have completed coursework in calculus through differential equations and a calculus-based general physics sequence. A course in modern physics, including some basic quantum mechanics, is strongly recommended.

This program is also available on the Web, and at televised viewing sites throughout the Chicago area. Students should consult www.iit-online.iit.edu for more information.

Required Courses

PHYS 561 Radiation Biophysics
PHYS 566 Radiation Health Physics
OR
PHYS 579 Therapeutic Medical Physics II
PHYS 571 Radiation Physics I
PHYS 572 Radiation Physics II
PHYS 573 Standards, Statutes, and Regulations
PHYS 576 External Dosimetry
PHYS 577 Internal Dosimetry
PHYS 578 Therapeutic Medical Physics I
PHYS 770 Instrumentation for Radiation Health Physics
COM 423 Communication in the Workplace
CHEM 513 Statistics for Analytical Chemists
INTM 511 Industrial Leadership
PHYS 568 Business Principles/Project Management

Master of Science in Physics

32 credit hours
Comprehensive examination
Thesis and oral defense

For those interested in research, seven to nine credit hours of PHYS 591 (Thesis Research) may be applied to the 32-credit-hour requirement. The basic program of coursework must include two semesters of PHYS 585 or PHYS 685 (Colloquium) and the M.S. core:

PHYS 501 Methods of Theoretical Physics I
PHYS 505 Electromagnetic Theory
PHYS 508 Analytical Dynamics
PHYS 509 Quantum Theory I

The remaining course requirements may be satisfied by additional graduate or advanced undergraduate electives.

Doctor of Philosophy in Physics

84 credit hours, approved by faculty adviser
Written qualifying examination
Comprehensive examination
Dissertation and oral defense, supervised by faculty member and approved by thesis committee

The requirements for the degree consist of a program of 84 credit hours approved by the faculty adviser; passing the Ph.D. qualifying and comprehensive examinations; and the completion of a research thesis supervised by a faculty member and approved by a thesis committee. Students should consult the section Transfer Credits in this bulletin for rules on how many credit hours may be transferred from another institution. The required coursework includes 4 semesters of PHYS 585 or PHYS 685 (Colloquium) and the graduate core:

PHYS 501 Methods of Theoretical Physics I
PHYS 505 Electromagnetic Theory
PHYS 508 Analytical Dynamics
PHYS 509 Quantum Theory I
PHYS 510 Quantum Theory II
PHYS 515 Statistical Mechanics

and at least three specialized or advanced physics graduate courses chosen from the following:

PHYS 502 Methods of Theoretical Physics II
PHYS 507 Electrodynamics
PHYS 510 Quantum Theory II
PHYS 533 Group Theory in Physics
PHYS 537 Physics of the Solid State I
PHYS 538 Physics of the Solid State II
PHYS 539 Physical Methods of Characterization
PHYS 545 Particle Physics I
PHYS 546 Particle Physics II
PHYS 553 Quantum Field Theory
PHYS 561 Radiation Biophysics
PHYS 570 Introduction to Synchrotron Radiation

The remaining course requirements may be satisfied by additional graduate or advanced undergraduate electives and research. Students are encouraged to participate in faculty research programs and seminars early in their graduate careers. Thesis work may follow from these activities. All research for the dissertation must be carried out under the direct supervision of a faculty research adviser. Students must have passed the written qualifying examination before registering for PHYS 691 (Ph.D. Thesis Research).

Certificate Programs

Analytical Method Development

Required courses

CHEM 506 Sampling and Sample Preparation
CHEM 508 Analytical Methods Development

AND two courses selected from the list of elect ives below.

Analytical Spectroscopy

Required Courses

CHEM 505 Spectroscopic Methods I
CHEM 512 Spectroscopic Methods II

AND two courses selected from the list of electives below.

Chromatography

Required Courses

CHEM 515 Fundamentals of Separation Science
CHEM 516 Applied Liquid and Gas Chromatography

AND two courses selected from the list of electives below.

Electives for Analytical Method Development, Analytical Spectroscopy and Chromatography

CHEM 500 Advanced Analytical Chemistry
CHEM 515 Fundamentals of Separation Science
CHEM 516 Applied Liquid and Gas Chromatography
CHEM 505 Spectroscopic Methods
CHEM 506 Sampling and Sample Preparation
CHEM 509 Physical Methods of Characterization
CHEM 512 Spectroscopic Methods II
CHEM 513 Statistics for Analytical Chemists
CHEM 542 Polymer Charicterization and Analysis
CHEM 543 Analytical Chemistry in Pharmaceutical Sciences
CHEM 544 Colloids and Colloid Analysis

Characterization of Inorganic and Organic Materials

Required Courses

CHEM 505 Spectroscopic Methods I
CHEM 509 Physical Methods of Characterization
CHEM 512 Spectroscopic Methods II

AND one course selected from the list of electives on the following page.

Synthesis and Characterization of Inorganic Materials

Required Courses

CHEM 505 Spectroscopic Methods I
CHEM 521 Structural, Inorganic and Materials Chemistry
CHEM 522 Efficient Synthesis and Catalytic Chemistry

AND one course selected from the list of electives on the following page.

Synthesis and Characterization of Organic Materials

Required Courses

CHEM 505 Spectroscopic Methods I
CHEM 531 Tactics in Organic Synthesis
CHEM 539 Introduction to Pharmaceutical Chemistry

AND one course selected from the list of electives on the following page.

Electives for Characterization of Inorganic and Organic Materials, Synthesis and Characterization of Inorganic Materials, and Synthesis and Characterization of Organic Materials

CHEM 509 Physical Methods of Characterization
CHEM 512 Spectroscopic Methods II
CHEM 535 Polymer Synthesis
CHEM 542 Polymer Characterization and Analysis
CHEM 543 Analytical Chemistry in Pharmaceutical Sciences

Radiological Physics

12 total credits selected from:

PHYS 561 Radiation Biophysics
PHYS 566 Environmental Health Physics
PHYS 571 Radiation Physics I
PHYS 572 Radiation Physics II
PHYS 573 Standards, Statutes and Regulations
PHYS 575 Case Studies in Health Physics
PHYS 576 Internal Dosimetry
PHYS 577 External Dosimetry
PHYS 578 Therapeutic Medical Physics I
PHYS 579 Therapeutic Medical Physics II
PHYS 770 Instrumentation for Radiation Health Physics

Course Descriptions

Numbers in parentheses represent class, lab and total credit hours, respectively.

Biology

BIOL 503
Virology
This course will cover topics related to animal viruses, including the cycle of major viral classes, viral pathogenesis, emergence, and control. Recent advances in these areas will be discussed in conjunction with readings from the original literature. Prerequisite: BIOL 445 or BIOL 544
(3-0-3)

BIOL 504
Biochemistry Lectures
Molecules of biological significance; reaction thermodynamics and kinetics; metabolism; cellular localization of biochemical function; proteins; nucleic acids; transcription; translation. Prerequisites: BIOL 115 and CHEM 237 or equivalent.
(4-0-4)

BIOL 511
Project Management: Business Principles
Introduction to concepts and techniques used to design and/or analyze a project to develop a set of tasks to accomplish the project, to coordinate and to monitor the work involved in the tasks, and to deliver a final product or service. Budgetary considerations will also be discussed.
(2-0-2)

BIOL 512
Advanced Biochemistry
This course provides a basic yet solid understanding of metabolism, enzyme mechanisms, and kinetics, as well as theoretical aspects of various laboratory techniques used in biochemistry. Prerequisite: permission of instructor.
(3-0-3)

BIOL 514
Toxicology
Initial lectures cover basic principles in chemical toxicity, such as dose response, indices of numerical toxicity, metabolism and factors influencing toxicity. Mechanisms of organic toxicity will be presented to include central nervous system, liver, kidney, respiratory system, reproductive system and the hematological system. Special topic lectures will emphasize the mechanism of toxicity for specific metals, pesticides, solvents and substances of abuse.
(3-0-3)

BIOL 515
Molecular Biology
A survey of topics including structure of nucleic acids, translation, transcription, replication, organization of DNA, RNA processing, genomics, and control of gene expression. Prerequisite: BIOL 401 or equivalent or instructor's consent.
(3-0-3)

BIOL 519
Biochemistry Laboratory
Introduction to modern biochemical techniques, including analytical methods for macromolecules, enzyme reactions, spectrophotometry, purifications, centrifugation, chromatography, electrophoresis, structure modeling. Prerequisite: Previous or concurrent enrollment in BIOL 401 or BIOL 504 or instructor's consent.
(0-9-3)

BIOL 520
Advanced Biochemistry Laboratory
A continuation of BIOL 519 in which students will undertake individual research projects. Prerequisite: BIOL 519 and instructor's consent.
(0-9-3)

BIOL 521
Advanced Micro Genetics Lab
Introduction to independent research in microbial physiology and genetics. Prerequisite: instructor's consent.
(0-9-3)

BIOL 522
Research Techniques in Biology
Experimental techniques in Biochemistry, Cell Biology, Biotechnology and Microbiology are offered as discreet modules. Students select appropriate modules to complement other laboratory courses. Thus, a student who has completed, for example, BIOL 519, (Biochemistry Laboratory) would select two modules chosen from Cell Biology, Biotechnology or Microbiology. A written report is required at the completion of each module.
(0-9-3)

BIOL 526
Developmental Biology
This course covers the cellular and molecular processes involved in generating an embryo, in creating various tissues and organs, and the effect of external stimuli on development. Topics include: genome structure, gene expression and regulation, cell cycle control, pattern formation, signal transduction, gametogenesis, organogenesis, and methods used in studying developmental biology. In addition to studies of model organisms, examples relevant to human diseases are covered.
(3-0-3)

BIOL 527
Immunology and Immunochemistry
Basic concepts of immunology and immunochemistry, both biological and molecular. Prerequisite: BIOL 401 or equivalent or instructor's consent.
(3-0-3)

BIOL 533
Laboratory in Cell and Molecular Biology
This course covers a number of essential techniques in cell and molecular biology with emphases on both the methodologies and the experimental details. Laboratory procedures include basic cell culture skills and relevant laboratory equipment usage. Experimental procedures include polymerase chain reaction and human DNA polymorphism, Drosophila polytene chromosome cytology, plasmid DNA preparation, western blot, gene delivery, yeast two-hybrid screens, immunofluorescence, immunoprecipitation, cell cycle arrest and analysis, and cell differentiation. Prerequisite BIOL 445 or instructor's consent.
(0-9-3)

BIOL 539
Advanced Cell Biology Laboratory
Introduction to independent research in cell and molecular biology. Prerequisite: BIOL 533 and instructor's consent.
(0-9-3)

BIOL 542
Advanced Microbiology
This course surveys a variety of topics regarding the biology of microbes. These include cell structure, metabolism, physiology, strategies for obtainng energy and how this relates to microbial ecology, genetics, and comparative genomics.
(3-0-3)

BIOL 544
Molecular Biology of Cells
This is a graduate level cell biology course. The course contains two parts: initial lectures cover cellular structure and function emphasizing the molecular components, organelles, and regulation of cellular process; the second part covers special topics emphasizing experimental approaches and molecular mechanisms of cellular regulation. Prerequisites: BIOL 115 and BIOL 214 or equivalent.
(3-0-3)

BIOL 545
Advanced Cell Biology Lectures
This course is a continuation of Biol 544 and focuses on recent advances in the area of cell biology. The course covers, in depth, eukaryotic cellular processes, structure-function relationships, and cellular signaling networks in response to physiological and pathological stimuli. The course will also cover frontier topics in the area of cell biology. Emphasis will be on experimental approaches. Prerequisites: BIOL 445/544 and BIOL 446/533, or instructor's consent.
(3-0-3)

BIOL 550
Bioinformatics and Biotechnology
This course will present an historical introduction to bioinformatics as a driving force for biotechnological advances. Topics covered will include: collecting and storing sequences in the lab; alignment of pairs of sequences; multiple sequence alignment; phylogenetic prediction; database searching for similar sequences; gene prediction; protein classification and structure prediction; and genome analysis.
(3-0-3)

BIOL 555
Macromolecular Structure Determination
Macromolecular crystallographic methods, including crystallization, data processing, phasing, and structure refinement; multi-dimensional NMR techniques; spectroscopic techniques; structural comparisons and characterizations; fiber diffraction and solution scattering. Prerequisite: instructor's consent.
(3-0-3)

BIOL 562
Current Topics in Functional Genomics
This course is designed to give students a foundation in advanced theoretical and applied methods in modern molecular research. It will emphasize both established and novel approaches to solving problems of functional and comparative genomics, and systems biology. It will also focus on applications of advanced molecular techniques in areas of significant economic and biomedical importance. Prerequisite: BIOL 515 or instructor's consent.
(3-0-3)

BIOL 572
Literature in Biochemistry
A topic from the current literature in biochemistry is selected by students for preparation of a paper. Prerequisite: instructor's consent.
(3-0-3)

BIOL 574
Literature in Biotechnology
A topic from the current literature in biotechnology is selected by students for preparation of a paper. Prerequisite: instructor's consent.
(3-0-3)

BIOL 576
Literature in Cell and Molecular Biology
A topic from the current literature in cell and molecular biology is selected by students for preparation of a paper. Prerequisite: instructor's consent.
(3-0-3)

BIOL 578
Literature in Microbiology
A topic from the current literature in microbiology is selected by students for preparation of a paper. Prerequisite: instructor's consent.
(3-0-3)

BIOL 580
Laboratory Rotation in Molecular Biochemistry and Biophysics
Short, individual research projects under the supervision of departmental faculty. Students will rotate through 2-3 different faculty laboratories in one semester. This helps ensure a good match between supervisor, project and student as well as provide a broader technical base to the student than provided in a single laboratory. This course may be taken twice. Prerequisite: instructor's consent.
(0-9-3)

BIOL 584
Graduate Seminar in Biology
To foster scientific communication skills, students are required to present seminars based on the scientific literature.
(1-0-1)

BIOL 591
M.S. Thesis Research
(Credit: Variable)

BIOL 595
Biology Colloquium
Lectures by invited scientists in areas of biology generally not covered in the department.
(1-0-1)

BIOL 597
Special Problems
(Credit: Variable)

BIOL 691
Ph.D. Thesis Research
(Credit: Variable)

Undergraduate Courses available to Graduate Students

BIOL 401
Introductory Biochemistry

BIOL 402
Metabolic Biochemistry

BIOL 410
Medical Microbiology

BIOL 414
Genetics for Engineering Students

BIOL 426
Concepts of Cancer Biology

BIOL 430
Animal Physiology

BIOL 445
Cell Biology

PHYS 410
Molecular Biophysics

Chemistry

CHEM 500
Advanced Analytical Chemistry
An overview of analytical chemistry with discussions of complex ionic equilibria, electroanalytical techniques including potentiometric, voltametric, coulometric and conductometric methods, ion chromatography, capillary electrophoresis and sensor technology.
(3-0-3)

CHEM 505
Spectroscopic Methods I
Theories of spectroscopic transitions and their applications in structural elucidations and quantitative analysis. Topics include ultraviolet/visible, infrared, Raman and nuclear magnetic resonance spectroscopy and mass spectrometry.
(3-0-3)

CHEM 506
Sampling and Sample Preparation
Techniques and devices for sampling in diverse media will be treated, followed by a discussion of sample treatment prior to analysis including isolation, concentration and fractionation of analytes and classes of analytes.
(3-0-3)

CHEM 508
Analytical Methods Development
A seminar course presenting analytical methods in complex matrices with emphasis on methods development and validation.
(2-0-2)

CHEM 509
Physical Methods of Characterization
A survey of physical methods of characterization including x-ray diffraction and fluorescence surface techniques, including SEM, TEM, AES and ESCA, thermal methods and synchrotron radiation methods.
(3-0-3)

CHEM 511
Project Management
Introduction to concepts and techniques used to design and/or analyze a project to develop a set of tasks to accomplish the project, to coordinate and to monitor the work involved in the tasks, and to deliver a final product or service. Budgetary considerations will also be discussed.
(2-0-2)

CHEM 512
Spectroscopic Methods II
A continuation of the study of optical methods covering atomic absorption spectroscopy, atomic and flame emission spectroscopy, chemiluminescence, fluorescence, phosphorescence, light scattering and refractometry.
(2-0-2)

CHEM 513
Statistics for Analytical Chemists
A survey providing sufficient statistical background for scientists. The topics covered include probability, statistics, sampling estimation, regression analysis, experimental design, data analysis and signal enhancement.
(3-0-3)

CHEM 515
Gas Chromatography - Theory and Practice
This course will cover theory and concepts of gas chromatographic analysis and its practical application in solving analytical problems. Topics include basic theory of chromatographic separation, separation dynamics, instrumentation, column selection, quantitative techniques, and practical applications.
(3-0-3)

CHEM 516
Liquid ChromatographyTheory and Practice
This course will cover the operating principles and applications of the state of the art LC/HPLC instrumentation and analysis. Topics include basic theory of liquid chromatography, instrumentation, optimization of LC separation, quantitative techniques, and the diverse range of analytical applications amenable to LC analysis. Prerequisite: CHEM 515.
(3-0-3)

CHEM 520
Advanced Inorganic Chemistry
Selective treatment of the chemistries of main group and transition elements with emphasis on coordination complexes, organometallic compounds and inorganic cages and clusters. Discussions of molecular symmetry, stereochemistry, bonding, electronic spectra, magnetic properties, reactions, kinetics and reaction mechanisms are included.
(3-0-3)

CHEM 521
Structural Inorganic and Materials Chemistry
This course covers structure and bonding and structure-property relationships in inorganic molecules and solids. Descriptions of crystal structures, spectroscopic and x-ray diffraction techniques for structure determination and properties of solids are included.
(3-0-3)

CHEM 522
Efficient Synthesis and Catalytic Chemistry
Environmentally benign chemical pathways. High-yield and zero-waste chemical processes. Sustainability, representative industrial chemical processes, catalytic chemistry .
(3-0-3)

CHEM 524
Synthesis and Intellectual Property Management
This course focuses on the management of intellectual property. Professionals will lead discussions on the control and dissemination of materials concerning intellectual property. This will be combined with technical presentations by students in the classroom. Topics of discussion will include invention disclosures, intellectual property rights, proprietary materials, justification for patents, types of patents, terms of a patent, patents procedure, licensing procedure and security considerations. Access to patented materials and disclosure of materials under patent process will be covered.
(2-0-2)

CHEM 530
Organic Reaction Mechanisms
A study of important mechanism classes and their relationship to the major reactions of organic chemistry. Emphasis will be placed on the study of reaction intermediates and on the methods used to characterize reaction pathways. Topics will include chemical bonding, aromaticity, stereochemistry, substitution, elimination, carbanion chemistry, free radical reactions, photochemistry and concerted reactions. Prerequisite: CHEM 455 or equivalent is recommended.
(3-0-3)

CHEM 531
Tactics in Organic Synthesis
A study of modern synthetic strategies used in the preparation of complex organic molecules. Synthetic planning using the disconnection approach and the selection of reagents to solve regiochemical and stereochemical problems will be the underlying themes. Synthetic strategies to be discussed include tandem reactions, template and chelation effects, biomimetic tactics and the use of chiral terpenes, carbohydrates and amino acids in enantioselective syntheses. Target molecules will include natural products, pharmaceuticals and smart organic materials. Prerequisite: CHEM 530.
(3-0-3)

CHEM 535
Polymer Synthesis
In-depth study of polymer synthesis, kinetics of polymerization, solution and thermal properties, processing and characterization techniques and rheological behavior. Selected topics include high-performance polymers, conducting polymers, electrooptical polymers, water-soluble polymers, biopolymers, medicinal polymers, photosensitive polymers and liquid crystalline polymers. Prerequisite: CHEM 470 or instructor's consent.
(3-0-3)

CHEM 537
Polymer Chemistry Laboratory
This course will include the synthesis of a variety of polymers and their characterization using instrumental methods. Emphasis will be placed on factors that control polymer formation, methods for obtaining molecular weights and distributions of polymers, as well as thermal and mechanical characteristics of polymers. Prerequisite: CHEM 470 or instructor's consent.
(1-6-3)

CHEM 538
Physical Biochemistry
The principles and techniques of physical chemistry applied to proteins, nucleic acids, polysaccharides and lipids. Prerequisites: CHEM 239, CHEM 344 (or equivalent).
(3-0-3)

CHEM 539
Introduction to Pharmaceutical Chemistry
Fundamental concepts will be discussed, including modern principles of drug design; drug absorption, distribution and metabolism; theories of drug-receptor interactions; approaches to structure-activity relationships; chemical, physicochemical and structural considerations. The various classes of therapeutic agents will be surveyed with emphasis on possible modes of action. Methods of synthesis will be considered. Prerequisites: CHEM 239.
(3-0-3)

CHEM 542
Polymer Characterization and Analysis
Overview of various characterization and analysis techniques in polymer science and technology, such as thermal analysis, mechanical property measurements, chromatographic separations, techniques for the determination of molecular weights and chemical analysis of polymer additives in polymer research, product development, quality control and degradation studies. A general discussion on industrial problem solving using multiple characterization techniques.
(3-0-3)

CHEM 543
Analytical Chemistry in Pharmaceutical Laboratories
This course is designed to compliment the current curriculum of the professional master degree in analytical chemistry. It is a review of the requirements a student may face as a professional chemist in a regulated industry. The course focus is on the requirements and common topics facing today's pharmaceutical industry. While individual agencies have specific regulations, the fundamental ideas of these regulations are largely consistent across the board. For example, an analytical chemist versed in Good Laboratory Practices (GLP) under FDA can quickly pick up the GLP's required by EPA.
(2-0-2)

CHEM 544
Colloids and Colloid Analysis
This course will begin a general overview of colloid science. This part of the course will introduce various types of colloids, touch on factors and conditions leading to their stability or instability, consider their evolution and will include a very limited discussion of the conditions under which they can form. The second part of the course will consist of a series of discussions of specific analytical techniques used to characterize colloidal systems, with particular emphasis on the physical characterization of the dispersed phase.
(2-0-2)

CHEM 550
Quantum Chemistry
Postulatory basis of quantum mechanics. Applications to molecules and band theory, and to interpretation of bond formation via spectroscopy. Range of models from 1-D rectangular well to complex molecules. Approximation methods such as Moller-Plesset Perturbation Theory, and Density Functional Theory, and their application to estimation ofphysical properties of complex molecules including transition states in reaction mechanisms and simulation. Prerequisites: Chem 344 or consent of instructor.
(3-0-3)

CHEM 552
Chemical Kinetics
Types of reactions, reaction order, activation energy, transition states, isotope effects and the mechanism of reactions. Determination of the rates of free radical reactions. Primary processes in thermal, photochemical and other radiation-induced reactions. Prerequisites: CHEM 550, CHEM 553 (or equivalent).
(3-0-3)

CHEM 553
Introduction to Chemical Thermodynamics
Fundamental laws of thermodynamics; application to simple chemical systems. Prerequisite: CHEM 344 or equivalent.
(3-0-3)

CHEM 560
Advanced Chemistry Projects
Advanced chemistry projects to be carried out under the direction of a faculty member. These projects may involve computational, theoretical, experimental work or a combination of these. Projects based on experimental work may be carried out in the research lab of the instructor. Topics of the advanced projects will be selected by the faculty member offering the course and will not necessarily be related to the dissertation topic of the student.
(0-12-4)

CHEM 584
Graduate Seminar in Chemistry
To foster scientific communications skills, students are required to present seminars based on the scientific literature. Required of all first-year M.S. and Ph.D. students.
(1-0-1)

CHEM 585
Chemistry Colloquium
Lectures by invited scientists in areas of chemistry generally not covered in the department. Must be taken two times by M.S. students and four times by Ph.D. students.
(1-0-1)

CHEM 591
Thesis Research
(Credit: Variable)

CHEM 594
Special Problems
Designed for non-thesis M.S. only.
(Credit Variable)

CHEM 597
Reading and Special Problems
Independent study to meet the special needs of graduate students in department-approved graduate degree programs. Requires the written consent of the instructor. May be taken more than once. Receives a letter grade.
(Credit Variable)

CHEM 610, 611
Special Topics in Analytical Chemistry
Topics of current interest in analytical chemistry including advanced electrochemistry, surface spectroscopy of electrode surfaces, separations, laboratory automation and new spectroscopic techniques.
(2-0-2;2-0-2)

CHEM 620, 621
Special Topics in Inorganic Chemistry
Topics of current interest in inorganic chemistry, including organometallic chemistry, homogeneous catalysis, inorganic reaction mechanisms, inorganic stereochemistry, materials chemistry, x-ray crystallography, synthetic and physical methods in inorganic and materials chemistry and chemical applications of group theory.
(2-0-2;2-0-2)

CHEM 630, 631
Special Topics in Organic Chemistry
Topics of current interest in organic chemistry including photochemistry, fluorine chemistry, heterocyclic chemistry, pharmaceutical chemistry and electrooptical organic chemistry. Prerequisite: CHEM 455 or instructor's consent.
(2-0-2;2-0-2)

CHEM 635
Heterocyclic Chemistry
Of the vast array of structures which organic compounds adopt, many contain ring systems as a component. When the ring is made up of carbon and at least one other element, the compound is classified as a heterocycle. The aims of this course are to identify the effects that the presence of such ring systems have on the chemistry of a molecule; to show how the rings can be made, and to describe some of the uses of the compounds in organic synthesis, in medicine and in other contexts. The chemistry of aromatic five-, six- and seven-membered ring compounds with one or more nitrogen, oxygen and/or sulfur atoms will be emphasized. Prerequisite: CHEM 531.
(3-0-3)

CHEM 650, 651
Special Topics in Physical Chemistry
Topics of current interest in physical chemistry, including atmospheric chemistry, ion molecule reactions, laser chemistry, theories of gas phase reactions, scattering theory, interaction of radiation with matter, and time-dependent relaxation methods.
(2-0-2;2-0-2)

CHEM 684
Graduate Seminars in Chemistry
To foster scientific communications skills, students are required to present seminars based on the scientific literature. Required of all Ph.D. students who have passed the written qualifying examination.
(1-0-1)

CHEM 685
Chemistry Colloquium
Lectures by invited scientists in areas of chemistry generally not covered in the department. For full-time graduate students who have completed the CHEM 585 requirement.
(1-0-1)

CHEM 691
Ph.D. Thesis Research
(Credit Variable)

Undergraduate Chemistry Courses Available to Graduate Students

CHEM 415
Inorganic Chemistry

CHEM 416
Advanced Chemistry Laboratory

CHEM 45
Physical Chemistry III

CHEM 451
Modern Techniques in Chemical Literature

CHEM 454
Computer Applications in Chemistry

CHEM 455
Advanced Organic Chemistry

CHEM 470
Introduction to Polymer Chemistry

Physics

PHYS 501, 502
Methods of Theoretical Physics I, II
Linear vector spaces. Functions of a complex variable. Fourier series and integrals. Differential and integral equations. Special functions. Green's functions. Group theory. Prerequisite: MATH 252.
(3-0-3;3-0-3)

PHYS 505
Electromagnetic Theory
Maxwell's equations. Electromagnetic waves and radiation. Prerequisites: PHYS 414, MATH 252.
(3-0-3)

PHYS 507
Electrodynamics
Covariant formulation of Maxwell's equations. Variational principles of classical field theory. Theory of radiation reactions. Topics in contemporary electrodynamics. Prerequisite: PHYS 505.
(3-0-3)

PHYS 508
Analytical Dynamics
Newton's laws. Lagrange's equations. Central forces. Invariance properties and conservation laws. Collections of particles. Rigid body motions. Small vibrations. Hamilton's equations. Canonical transformations. Hamilton-Jacobi theory. Approximation methods. Special theory of relativity. Classical theory of fields. Prerequisites: PHYS 309, MATH 252. Recommended corequisite: PHYS 501.
(3-0-3)

PHYS 509, 510
Quantum Theory I, II
Postulates and theory of measurement in quantum mechanics. Momentum eigenstates, wave packets and passage to the classical limit. Angular momentum eigenstates. Stationary states of a particle in central field. Approximation methods. Identical particles, introduction to second quantization. Transition probabilities. S matrix formalism, approximation methods for decay and scattering problems. The Lorentz group and relativistic wave equations. Dirac particle in a central field. Prerequisites: PHYS 406, PHYS 501, PHYS 508 or instructor's consent.
(3-0-3;3-0-3)

PHYS 511, 512
Advanced Quantum Mechanics I, II
Applications and extensions of basic principles introduced in PHYS 509 and PHYS 510. Typical subject areas include atomic and molecular structure, group-theoretical analysis of spectra, many-body problems, including second quantization, density matrix. Hartree-Fock method. BCS theory. Introduction to quantum fields. Feynman diagrams. Green's functions, quantum electrodynamics. Prerequisites: PHYS 509, PHYS 510.
(3-0-3)

PHYS 515
Statistical Mechanics
Kinetic theory and Boltzmann's H-theorem. Quantum statistics. Fermi-Dirac and Bose-Einstein systems. Density matrix. Fluctuations. Behavior of complex and chaotic systems. Prerequisites: PHYS 304, PHYS 406 and PHYS 508, or instructor's consent.
(3-0-3)

PHYS 521
Quantum Electronics
The Schrodinger equation. Matrix formulation. Quantization of lattice vibrations and electromagnetic fields. Optical beams and resonators. The interaction of radiation and atomic systems. Lasers. Optical waveguides and devices. Frequency conversion. Quantum noise. Same as ECE 521. Prerequisite: ECE 307 or instructor's consent.
(3-0-3)

PHYS 533
Group Theory in Physics
Development of the theory of finite groups and group representations and application to diverse subjects in physics. Point groups. Introduction to SU(2) and the rotation group. Spinors and tensors. Prerequisite: MATH 252.
(3-0-3)

PHYS 537, 538
Solid State Physics I, II
Crystal structure and crystal binding. Lattice vibrations and phonons. Free electron model of metals and semiconductors. Energy band theory. Transport phenomena. Magnetic, optical properties of solids. Superconductivity. Prerequisites: PHYS 406, MATH 252.
(3-0-3;3-0-3)

PHYS 545, 546
Particle Physics I, II
Principal theories of elementary particles and their interactions, including important features of experimental data. Mesons, baryons and leptons. Particle classification schemes. Brief introduction to quantum field theory and Feynman diagrams. Strong, electromagnetic and weak interactions. Scattering matrix. Phenomenological descriptions of high-energy scattering and particle production. Speculations on quarks, magnetic monopoles and other exotic particles. Prerequisite: PHYS 510 or instructor's consent.
(3-0-3)

PHYS 553
Quantum Field Theory
Relativistic wave equations. Semiclassical and quantum theories of radiation. Photoelectric effect. Pair production. Bremsstrahlung. Compton scattering. Second quantization of the electron field. Renormalization. Lamb shift. Vacuum polarization. Exact methods for external field problems. Prerequisite: PHYS 505.
(3-0-3)

PHYS 561
Radiation Biophysics
Energy loss by ionizing radiation. Target theory. Direct and indirect action. Radiation effects in iomolecules. Radiation inactivation of enzymes, nucleic acids and viruses. Biological effects of ultraviolet radiation. Photosensitization. Radiation protection and sensitization. Radiation effects in vivo, radiation therapy, phototherapy. Prerequisite: PHYS 410 or instructor's consent.
(3-0-3)

PHYS 570
Introduction to Synchotron Radiation
Production and characterization of synchrotron radiation, dynamical and kinematical diffraction, absorption and scattering processes, x-ray optics for synchrotron radiation, and x-ray detectors. Overview of experimental techniques, including XAFS, XPS, SAXS, WAXS, diffraction, inelastic x-ray scattering, fluorescence spectroscopy, microprobe, tomography and optical spectroscopy.
(3-0-3)

PHYS 571
Health Physics I
Fundamentals of health physics will be presented, with an emphasis on problem-solving and computer modeling. Topics covered begin with the physics of radiation production: review of atomic and nuclear structure and quantum mechanics; nuclear structure and radioactivity; production of x-rays. The second part of the course focuses on the interaction of radiation with matter, including energy-loss mechanisms, secondary processes, stopping power and range. Required prerequisites: MATH 252, PHYS 203. Suggested prerequisite: PHYS 348.
(3-0-3)

PHYS 572
Health Physics II
Continuation of the basic health physics sequence, including neutron production and interaction with matter; methods of radiation detection; radiation dosimetry; chemical and biological effects of radiation; radiation protection standards; shielding; dosimetric models; accelerator, reactor and medical health physics. Prerequisite: PHYS 571.
(3-0-3)

PHYS 573
Standards, Statutes, and Regulations
This course studies the requirements of agencies that regulate radiation hazards, their basis in law and the underlying U.S. and international standards. An array of overlapping requirements will be examined. The effect regulatory agencies have upon the future of organizations and the consequences of noncompliance are explored.
(3-0-3)

PHYS 575
Case Studies in Health Physics
Issues in operational health physics and regulatory affairs. Students will present problems and solutions drawn from their experience and the literature. Operational problems may include organizational issues, computer applications, measurements and dosimetry. Methods for compliance with EPA, NRC and OSHA and enforcement actions will emphasize technical and management techniques.
(3-0-3)

PHYS 576
Internal Dosimetry
Calculation of internal dose from radiation sources. Internal dose is a function of the form of radiocative material, route of intake, biochemistry, metabolic activity, and gross and cellular physiology.
(2-0-2)

PHYS 577
External Dosimetry
Calculation of external dose from radiation sources. External dose is determined for uniform fields, nonuniform fields, and local deposition. External sources include immersion in a cloud of radioactive gas and skin contamination.
(2-0-2)

PHYS 578
Therapeutic Medical Physics I
Fundamentals of therapeutic medical physics are presented with emphasis on clinical applications, problem solving and computer modeling. Topics covered begin with description of treatment machines for external beam radiotherapy, including clinical accelerators for x-ray, electron and proton radiotherapy; AAPM TG-21 and TG-51 protocols; Classical radiation therapy. Prerequisite: PHYS 572 or consent of instructor.
(2-0-2)

PHYS 579
Therapeutic Medical Physics II
Advanced topics in radiation therapy physics will be covered. Topics covered begin with three dimensional conformal radiation therapy followed by clinical dose computation algorithms: Convolution-Superposition Methods and direct Monte Carlo methods. Following topic is Intensity Modulated Radiation Therapy (IMR T), which will cover in details mathematical, physical and biological optimizations of beam intensity, IMRT dose delivery methods, and quality assurance aspects. Last topics to be covered are High Dose Rate (HDR) Brachytherapy and Stereotactic Radiosurgery. Required prerequisite: PHYS 578.
(2-0-2)

PHYS 585
Physics Colloquium
Lectures by invited scientists in areas of physics generally not covered in the department. Must be taken twice by M.S. students and four times by Ph.D. students.
(1-0-1)

PHYS 591
Thesis Research
(Credit Variable)

PHYS 597
Reading and Special Problems
ndependent study to meet the special needs of graduate students in department-approved graduate degree programs. Requires the written consent of the instructor. May be taken more than once. Receives a letter grade.
(Credit Variable)

PHYS 685
Physics Colloquium
Lectures by invited scientists in areas of physics generally not covered in the department. For full-time graduate students who have completed the PHYS 585 requirement.
(1-0-1)

PHYS 691
Thesis Research
(Credit Variable)

PHYS 770
Instrumentation for Radiation Health Physics
Detecting and measuring radioactive material and radiation levels depends upon many types of detectors and instrumentation. Theory of detectors ranging from chambers operating in pulse and current producing modes to solid-state detectors is applied to measuring and monitoring systems. Electronics ranging from simple-rate meters and scalers to high-speed multichannel analyzers is used. Computer linked instrumentation and computer-based applications are applied to practical problems.
(0-6-2)

Department of Biomedical Engineering

Wishnick Hall
3255 S. Dearborn
Chicago, IL 60616
312.567.5100
312.567.5770 (fax)
www.iit.edu/~biomed

Interim Chair: David Mogul

The Department of Biomedical Engineering confers a doctoral degree in biomedical engineering (Ph.D. in Biomedical Engineering). Currently, ten faculty members hold tenuretrack positions in the department. Several departments at IIT contribute courses and faculty to the graduate program: Biological, Chemical and Physical Sciences; Chemical and Environmental Engineering; Computer Science; Electrical and Computer Engineering; Mechanical, Materials and Aerospace Engineering; the Institute of Psychology; and the Center for Ethics in the Professions.

An M.D./Ph.D. program is in place whereby students with engineering backgrounds can receive a Ph.D. in Biomedical Engineering at IIT and an M.D. from the University of Chicago. Qualified students are admitted to the MSTP (Medical Scientist Training Program) at the University of Chicago and subsequently apply to the Department of Biomedical Engineering for their Ph.D. studies.

Degree Offered

Doctor of Philosophy in Biomedical Engineering

Research Areas

Cell and Tissue Engineering
Medical Imaging
Neural Engineering

Faculty

Mark Anastasio, Associate Professor. Ph.D., University of Chicago. Development and analysis of tomographic reconstruction algorithms, analytical and numerical analysis of inverse problems in biomedical imaging, theoretical imaging science, photoacoustic tomography.

Konstantinos Arfanakis, Associate Professor. Ph.D., University of Wisconsin-Madison. Magnetic resonance imaging (MRI), MRI acquisition and post-processing, diffusion tensor MRI (DTI), functional MRI (fMRI).

Robert Arzbaecher, Emeritus Professor. Ph.D., University of Illinois, Urbana-Champaign. Instrumentation, signal processing and control.

Eric M. Brey, Assistant Professor. Ph.D., Rice University. Angiogenesis, microvascular models, wound healing, tissue engineering.

Ali Cinar, Professor of Chemical Engineering, Dean of the Graduate College, and Vice Provost for Research. B.S., Robert College (Turkey); M.S., Ph.D., Texas A & M. Process modeling, monitoring, and control; agent-based systems for process supervision, complexity, AI applications, modeling and simulation of biomedical systems, diabetes.

Natacha DePaola, Dean of Engineering, and Professor of Biomedical Engineering. Ph.D., Massachussettes Institute of Technology. Biofluid dynamics, cell mechanics, and tissue engineering.

David Gatchell, Senior Lecturer. Ph.D., Boston University. Bioinformatics, bioengineering curricula.

Thomas C. Irving, Associate Professor. Ph.D., University of Guelph (Canada). Structure and biophysics of macro-molecular systems, muscle structure and physiology, synchrotron radiation instrumentation.

Derek Kamper, Associate Professor. Ph.D., Ohio State University. Neural control, biomechanics and rehabilitative medicine.

Jennifer J. Kang-Mieler, Associate Professor. Ph.D., Northwestern University. Models of thrombotic retinal vessel occlusion, blood flow, electroretinography.

David Mogul, Associate Professor and Interim Chair. Ph.D., Northwestern University. Neuronal networks, control of epilepsy, brain electrophysiology.

Georgia Papavasiliou, Assistant Professor. Ph.D., Illinois Institute of Technology. Mathematical modeling, design of polymeric biomaterials for tissue engineering and drug delivery applications.

Philip R. Troyk, Associate Professor. Ph.D., University of Illinois, Chicago. Polymers for electronics, neural implants, solid-state power systems.

Vincent Turitto, Director of Pritzker Institute of Biomedical Science and Engineering and Professor. D.Engr.Sci., Columbia University. Blood flow and thrombosis, atherosclerosis, cellular biodynamics, biomaterials.

Miles Wernick, Professor. Ph.D., University of Rochester. Medical imaging, image processing, pattern recognition.

Yongyi Yang, Professor. Ph.D., Illinois Institute of Technology. Image and signal processing, data compression, applied mathematical and statistical methods.

Affiliated Program Faculty

Hamid Arastoopour, Henry Linden Professor of Energy/Environment/Economics. B.S., Abadan Institute of Technology (Iran); M.S., Ph.D., Illinois Institute of Technology. Computational multiphase flow, pulverization and agglomeration of particles, fluidization, fluid-particle flow and material processing.

Victor Perez-Luna, Associate Professor, Department of Chemical and Environmental Engineering. B.S., M.S., Universidad de Guadalajara (Mexico); Ph.D., University of Washington. Surface analysis and modification, biomaterials, biosensors and tissue engineering.

Fouad A. Teymour, Johnson Polymer Professor of Chemical Engineering. B.S., M.S., Cairo University (Egypt); Ph.D. University of Wisconsin, Madison. Polymer reaction engineering, mathematical modeling, nonlinear dynamics.

Admission Requrements

Minimum cumulative undergraduate GPA: 3.2/4.0
GRE minimum scores:
1800 (combined)
1200 (quantitative + verbal) 3.0 (analytical writing)

Meeting the minimum admission standards for GPA and GRE scores does not guarantee admission. Test scores and GPA are just two of several important factors considered. The admissions committee will also consider recommendations from three college faculty members acquainted with the character, research ability, potential, qualifications and motivation of the applicant, and the needs of the depaartmental faculty. Entering graduate students are assigned a temporary academic adviser who will provide initial guidance. As their research and other academic interests become defined, students select a permanent research adviser,who will also guide them through their academic studies.

Doctor of Philosophy in Biomedical Engineering

Total Credit Hours 84
Qualifying examination (written and oral)
Thesis research proposal/comprehensive examination
Dissertation and oral defense

This degree is awarded in recognition of a high level of mastery in subject matter and a significant original research contribution in biomedical engineering. The Ph.D. recipient will be capable of a continuing effort toward the advancement of knowledge and achievement in research and other scholarly activities and may pursue a career in a medical, an industrial or an academic environment.

A minimum of 84 credit hours is required for the Ph.D. in Biomedical Engineering. Students who have received an M.S. degree from another university may petition for transfer of up to 32 credit hours applicable toward the Ph.D. degree. Students must pass the Ph.D. qualifying examination within the first year of full-time Ph.D. studies. This is a written and oral examination intended to explore both the depth and breadth of the students academic abilities. Within two and one-half years of matriculation, students will be required to defend their thesis research proposal (comprehensive examination). A written dissertation and oral defense are also required forreceiving the doctoral degree. Dissertation format and deadlines are established by the Graduate College.

There are no specific courses that are required for the doctoral degree in biomedical engineering. However, a minimum of three courses in life science, three courses in mathematics, and six courses in biomedical engineering or other engineering-related courses are required. The specific courses selected to meet these requirements will depend on the entering qualifications of the student and the nature of the thesis research proposal. In general, the students thesis committee will determine the specific course requirements necessary for graduation.

Biomedical engineering courses

BME 500 Introduction to Biomedical Engineering
BME 501 Biomedical Instrumentation
BME 502 Computational Neuroscience I: Single Neuron Computation
BME 503 Mathematics and Statistics for Neuroscience I
BME 504 Neuroethology
BME 505 Mathematics and Statistics for Neuroscience II
BME 506 Computational Neuroscience II: Vision
BME 507 Cognitive Neuroscience
BME 508 Mathematics and Statistics for Neuroscience III
BME 509 Vertebrate Neural Systems
BME 518 Advanced Reaction Kinetics
BME 521 Medical Imaging
BME 522 Mathematical Methods in BME
BME 525 Concepts of Tissue Engineering
BME 530 Inverse Problems in Biomedical Imaging
BME 532 Medical Imaging Science
BME 533 Biostatistics
BME 535 Magnetic Resonance Imgaing
BME 538 Neuroimaging
BME 540 Wave Physics and Applied Optics for Imaging Scientistss
BME 542 Advanced Concepts in Image Science
BME 543 Bioinstrumentation and Electronics
BME 551 Physiological Signal Analysis & Control Theory I
BME 552 Physiological Signal Analysis & Control Theory II
BME 553 Quantitative Physiology
BME 570 Engineering Biocompatible Materials
BME 575 Neuromechanics of Human Movement
BME 581 Fluid Dynamics for Biomedical Engineers
BME 582 Advanced Mass Transport for Biomedical Engineers
BME 585 Computational Models of the Human Cardiovascular System
BME 595 Seminar in Biomedical Engineering
BME 597 Wave Physics and Applied Optics for Imaging Scientists
BME 597 Neural Prosthesis
BME 691 Research and Thesis for Ph.D. degree

Life science courses (representative)

BIOL 403 General Biochemistry
BIOL 414 Genetics for Engineering Scientists
BIOL 430 Animal Physiology
BIOL 445 Cell Biology
BIOL 513 Advanced Biochemistry
BIOL 515 Molecular Biology
BIOL 527 Immunology and Immunochemistry
BIOL 550 Bioinfomatics and Biotechnology
BIOL 565 Vertebrate Physiology

Doctor of Philosophy in Biomedical Engineering (continued)

Approved math/applied math courses

MATH 461 Fourier Series and Boundary-Value Problems
MATH 471 Numerical Methods I
MATH 472 Numerical Methods II
MATH 476 Statistics
MATH 489 Partial Differential Equations
MATH 510 Ordinary Differential Equations
MATH 512 Partial Differential Equations
MATH 519 Complex Analysis
MATH 532 Linear Algebra
MATH 542 Stochastic Processes
MATH 546 Introduction to Time Series
MATH 555 Tensor Analysis
MATH 564 Applied Statistics
MATH 577 Computational Mathematics I
MATH 578 Computational Mathematics II
MATH 581 Theory of Finite Elements

Engineering or physics courses (representative) that may count toward math requirement

MMAE 501 Engineering Analysis I
MMAE 502 Engineering Analysis II
MMAE 503 Advanced Engineering Analysis
MMAE 505 Numerical Methods in Engineering
MMAE 506 Computational Methods in Engineering Analysis
MMAE 517 Computational Fluid Mechanics
CHE 535 Applications of Mathematics to Chemical Engineering
CHE 536 Computational Techniques in Engineering
PHYS 501 Methods of Theoretical Physics I
PHYS 502 Methods of Theoretical Physics II

Selected engineering electives

CS 480 Artificial Intelligence
CS 525 Advanced Database Organization
CS 580 Medical Informatics
CS 583 Expert Systems
CHE 450 Principles of Polymer Science and Engineering
CHE 532 Process Modeling
CHE 533 Statistical Analysis of Process Data
CHE 544 Kinetic Theory of Multiphase Flow
CHE 555 Polymer Processing
CHE 573 Bioseparations
CHE 575 Polymer Rheology
CHE 586 Particulate Technology
CHE 761 Statistical Design of Experiments for Process Improvement
CHE 577 Biochemical Engineering
CHE 579 Enzyme Reactor Engineering
CHE 582 Interfacial and Colloidal Phenomena with Applications
CHE 583 Pharmaceutical Engineering
CHE 585 Drug Delivery
ECE 433 Real-Time Data Acquisition and Processing
ECE 511 Analysis of Random Signals
ECE 565 Multidimensional Signal Processing
ECE 566 Statistical Pattern Recognition
ECE 567 Statistical Signal Processing
MMAE 407 Biomechanics
MMAE 467 Polymeric Materials
MMAE 507 Introduction to Continuum Mechanics
MMAE 510 Fluid Mechanics
MMAE 512 Dynamics of Viscous Fluids
MMAE 517 Computational Fluid Dynamics
MMAE 579 Characterization of Polymers

Course Descriptions

Note: For description of courses other than BME, see the appropriate departmental listing.

BME 500
Introduction to Biomedical Engineering
Introduction to the concepts and research in biomedical engineering. Provides an overview of current biomedical engineering research areas, emphasis on application of an engineering approach to medicine and physiology.
(3-0-3)

BME 501
Biomedical Instrumentation
Bioelectric phenomena, transducers, amplifiers. Processing of ECG, EMG and EEG signals.
(3-0-3)

BME 502
Computational Neuroscience I
This course briefly review the historical development of computational neuroscience and discusses the functional properties of individual neurons. The electrotonic structure of neurons, functional properties of synapses, and voltage-gated ion channels are discussed.
(3-0-3)

BME 503
Math/Statistics: Neuroscience I
This quarter introduces mathematical ideas and techniques in a neuroscience context. Topics will include some coverage of matricies and complex variables; eigenvalue problems, spectral methods and Grens functions for differential equations; and some discussion of both deterministic and probabilistic modeling in the neurosciences. Prerequisites: Consent of instructor.
(2-0-2)

BME 504
Neurobiology
This course is concerned with the structure and function of systems of neurons, and how these are related to behavior. Common patterens of organization are described from the anatomical, physiological, and behavioral perspectives of analysis. The comparative approach is emphasized throughout. Laboratories include exposure to instrumentation and electronics, and involve work with live animals. A central goal of the laboratory is to expose students to in vivo extracellular electrophysiology in vertebret preparations. Laboratoratries will be attended only on one day a week but may run well beyond the canonical perios. Neurobiology Prerequisites: Consent of instructor.
(2-0-2)

BME 506
Computational Neuroscience II: Vision
This course considers computational approaches to vision. It discusses the basic anatomy and physiology of the retina and central visual pathways, and then examines computational approaches to vision based on linear and non-linear systsms theory, and algorithms derived from computer vision.
(3-0-3)

BME 507
Cognitive Neuroscience
This course is concerned with the relationship of the nervous system to higher order behaviors such as perception and encoding, action, attention and learning and memory. Modern methods of imaging neural activity are introduced, and information theoretic methods for studying neural coding in individual neurons and populations of neurons are discussed. Consent of instructor.
(2-0-2)

BME 508
Math/Statistics: Neuroscience III
This quarter covers more advanced topics including perturbation and bifurcation methods for the study of dynamical systems; symmetry methods and some group theory. A variety of application to neuroscience will be described. Prerequisites: BME 503, BME 505, Consent of instructor.
(2-0-2)

BME 509
Vertebrate Neural Systems
This lab-centered course teaches students the fundamental principles of mammation neuroanatomy. Students learn the major structures and the basic circuitry of the CNS and PNS. Students become practiced at recognizing the nuclear organization and cellular architecture of many regions in animal brain models. This course is taught at The Univerisity of Chicago. Prerequisite: Consent of instructor.
(2-1-3)

BME 518
Advanced Reaction Kinetics
A graduate level course in the principles of chemical kinetics. Analysis of rate data; single and multiple reaction schemes. Biomedical topics include: enzymatic pathways, biological systems, receptor-ligand kinetics, microbial cell growth and product formation, and the design and analysis of biological reactors.
(3-0-3)

BME 521
Medical Imaging
Study of modern technology for medical imaging. Theory and operation of CAT, SPECT, PET, MRI, X-ray and echo imaging modalities.
(3-0-3)

BME 522
Mathematical Methods in BME
This course is an introductory graduate level course that integrates mathematical and computational tools that address directly the needs of biomedical engineers. The topics covered include the mathematical or diffusion, pharmacokinetic modesl, biological fluid mechanics, and biosignal representations and analysis. The use of MATLAB will be emphasized for numerically solving problems of practical relevance. Prerequisites: Graduate standing in BME or consent of instructor.
(3-0-3)

BME 525
Concepts of Tissue Engineering
This course seeks to provide students with an introduction to the field of Tissue Engineering. The first portion of the course will introduce the field, including a discussion of cell sorcing, biomaterials, DA, and ethical consideration. The second portion of the course will present case studies in specific tissue and organ systems in which these concepts are put together in an attempt to develop a clinically applicable tissue engineered product.
(3-0-3)

BME 530
Inverse Problems in Biomedical Imaging
This course will introduce graduate students to the mathematical theory of inverse problems. Concepts from functional analysis will be applied for understanding and characterizing mathematical properties of inverse problems. This will permit for the analysis of the stability and resolution of image reconstruction algorithms for various existing and novel biomedical imaging systems. The singular value decomposition (SVD) is introduced and applied for understanding fundamental properties of imaging systems and reconstruction algorithms.
(3-0-3)

BME 532
Medical Imaging Science
This course is an introduction to basic concepts in medical imaging, such as: receiver operating characteristics, the rose model, point spread function and transfer function, covariance and autocovariance, noise, filters, sampling, aliasing, interpolation, and image registration.
(3-0-3)

BME 533
Biostatistics
This course is designed to cover the tools and techniques of modern statistics with specific applications to biomedical and clinical research. Both parametric and nonparametric analysis will be presented. Descriptive statistics will be discussed although emphasis is on inferential statistics and experimental design.
(3-0-3)

BME 535
Magnetic Resonance Imaging
This course is an introduction to magnetic resonance imaging (MRI). It includes basic MR physics, the principles of selective excitation, signal detection, and MR image reconstruction, different pulse sequences, MRI hardware, issues on image quality and artifacts, and advanced MRI techniques.
(3-0-3)

BME 538
Neuroimaging
This course describes the use of different imgaging modalities to study brain function and connectivity. The first part of the course deals with brain function. It includes an introduction to energy metabolism in the brain, cerebral blood flow, and brain activation. It continues with an introduction to magnetic resonance imaging (MRI), perfusion-based fMRI, BOLD fMRI, fMRI paradigm design and statistical analysis, introduction to positron emission tomography (PET) and studying brain function with PET, introduction to magnetoencephalography (MEG) and studying brain function with MEG. The second part of the course deals with brain connectivity. It includes an introduction to diffusion tensor MRI, explanation of the relationship between the diffusion properties of tissue its structural characteristics, and white matter fiber tractography techniques.
(3-0-3)

BME 540
Wave Physics and Applied Optics for Imaging Scientists
This course will introduce students to fundamental concepts in wave physics and the analysis of optical wavefields. These principles will be utilized for understanding existing and novel imaging methods that employ coherent radiation. Solutions to inverse scattering and inverse source problems will be derived and algorithmic realizations of the solutions will be developed. Phase-contrast imaging techniques and X-ray imaging systems that employ coherent radiation will be studied.
(3-0-3)

BME 542
Advanced Concepts in Image Science
This graduate level course introduces students to fundamental concepts in image science that are related to the optimization and evaluation of biomedical imaging systems. Topics covered include: deterministic descriptions of imaging systems, stochastic descriptions of imaging systems, statistical cdecision theory, and objective assessment of image quality. Prerequisites: BME 530, BME 532, or consent of instructor.
(3-0-3)

BME 543
Bioinstrumentation and Electronics
Principles of circuit analysis are applied to typical transducer and signal recording situations found in biomedical engineering. Basic electrical and electronic circuit theory is reviewed with an emphasis on biomedical measurement applications. A special topic is individually studied by the student and presented to the class electrical physics class or basic circuits.
(3-0-3)

BME 551
Physiological Signal Analysis & Control Theory I
This is the first of a 2 part course co-taught at IIT and the University of Chicago. essential elements of signal processing and control theory as it is applied to physiological systems will be covered. Part I will cover data acquisition and sampling, Laplace and Fourier transforms, filtering, time and frequency domains, sytem descriptions and lumped vs. distributed parameters. Students will use Matlab to test concepts presented in class.
(2-0-2)

BME 552
Physiological Signal Analysis & Control Theory II
This is the second part of a 2 part course co-taught at IIT and the University of Chicago. Part II will cover time and frequency domain analysis, impulse vs. step response functions, open vs. closed loop responses, stability, systems identification and control, non-linear control. Students will use Matlab to test concepts presented in class.
(2-0-2)

BME 553
Quantitative Physiology
The primary objective of this course is to introduce students to basic physiological concepts using a quantitative approach. The main systems that control the human body functions will be reviewed to enable the students to understand the individual role of each major functional system as well as the need for the integration or coordination of the activities of the various systems. Attempts will be made to highlight the patho-physiological consequences of defects or failures in the organ systems, and the relevant corrective approaches. This course will include lectures from individuals who have relevant expertise in the different organ systems because of the complexity of the human body. Prerequisite: BME 100.
(3-0-3)

BME 570
Engineering Biocompatible Materials
The primary objective of this course is to introduce students to synthetic materials that are routinely used as componets of various medical devices implanted in the human body. In this course, students will critically examine prosthetic materials used in specific devices (for example: muscle, eye, skin, vascular). The biological environment relevant to the discussed implant will be reviewed. Problems with current materials will be analyzed and strategies and techniques required to engineer sophisticated biomaterials for future applications will be developed. Legal procedures required to obtain FDA approval for such materials will be taught. Industry personnel specializing in medical implants will deliver guest lectures.
(3-0-3)

BME 575
Neuromechanics of Human Movement
This course will explore how we control movement of our extremities, with concepts drawn from mechanics and neurophysiology. The progression from neurological signals to muscle activation and resulting movement of the hand or foot will be modeled, starting at the periphery and moving back toward the central nervous system. Biomechanics of the limbs will be modeled using dynamic simulation software (Working Model) which will be driven by a neural controller, implemented in MATLAB. Issues related to sensory feedback and redundancy will be addresses.
(3-0-3)

BME 581
Fluid Dynamics for Biomedical Engineers
This course is primarily focused on the development of theoretical and experimental principles necessary for the delineation of fluid flow in various in vitro chambers and the cardiovascular system. Its content will primarily deal with the basic concepts of flow in various geometries, the heterogeneous nature of blood and the application of such principles in flow chambers designed to expose blood elements to defined flow conditions. The relationship to flow in the normal and diseased vascular system will also be considered.
(3-0-3)

BME 582
Advanced Mass Transport for Biomedical Engineers
The development of theoretical and mathematical principles necessary for the delineation of mass transport processes in biological and medical systems. Herogeneous reactions which occur at or in the vicinity of cells. Basic transport mechanisms in the vasculature, across cells or within tissues.
(3-0-3)

BME 585
Computational Models of the Human Cardiovascular System
Introductory fluid dynamics. This course will focus on the use of computational fluid dynamics for the modeling and analysis of the human cardiovascular system. The course will cover both computational methods for fluid dynamics and biomedical aspects of the human cardiovascular system. Computer models for the simulation and analysis of hemodynamic phenomena will be developed.
(3-0-3)

BME 595
Seminar in Biomedical Engineering
Current research and development topics in biomedical engineering as presented by outside speakers, faculty and advanced students.
(3-0-3)

BME 597
Neural Prostheses
The goal of this course is to provide students the fundamentals of sensory and motor neural prosthetic devices. Principles of recording from, and electrical stimulation of, neural tissue will be presented. Students will study past and current literature for specific neural prosthesis systems.
(3-0-3)

BME 691
Research and Thesis for Ph.D. degree
(Variable credit)

Courses co-offerd at the University of Chicago

BME 502
Computational Neuroscience I: Single neuron computation

BME 503
Mathematics and Statistics for Neuroscience I

BME 504
Neuroethology

BME 505
Mathematics and Statistics for Neuroscience II

BME 506
Computational Neuroscience II: Vision

BME 507
Cognitive Neuroscience

BME 508
Mathematics and Statistics for Neuroscience III

Department of Chemical and Biological Engineering

127 Perlstein Hall
10 W. 33rd St.
Chicago, IL 60616
312.567.3040
312.567.8874 fax
chbe@iit.edu
www.chbe.iit.edu

Interim Chair:
John Kallend

Liaison, Environmental Management Program:
Fouad Teymour

The mission of the Department of Chemical and Biological Engineering is to meet the present and future needs of society and industry by providing state-of the-art education and research programs. In order to accomplish this mission, the department provides graduate students with:

- Fundamental knowledge and design capability in biological engineering, chemical engineering, gas engineering, and food process engineering.
- Advanced research programs in core competency areas.
- Knowledge of industrial ecology/design for the environment
- Understanding of ethical, economic and social issues that influence intellectual technological choices.
- Leadership and communication skills.
- Lifelong learning capabilities.

Degrees Offered

Master of Biological Engineering
Master of Chemical Engineering
Master of Science in Chemical Engineering
Doctor of Philosophy in Chemical Engineering

With the National Center for Food Safety and Technology:
Master of Food Process Engineering
Master of Science in Food Process Engineering

Dual Degree Programs

Master of Science in Computer Science/Master of Chemical Engineering

Certificate Programs

Biological Engineering
Current Energy Issues
Food Process Engineering
Food Processing Specialist
Particle Processing
Pharmaceutical Engineering
Polymer Science and Engineering
Process Operations Management

Interdisciplinary Programs

Energy/Environment/Economics (E^3) specialization

With the Stuart School of Business:
Master of Science in Environmental Management (degree is offered by the Stuart School of Business)

Research Centers

Center for Electrochemical Science and Engineering: Jai Prakash, director

Center of Excellence in Polymer Science and Engineering: David Venerus, director

Center for Molecular Study of Condensed Soft Matter: Jay Schieber, director

Center for Complex Systems and Dynamics: Fouad Teymour, director

Research Facilities

Research facilities of the department include:

- Biochemical Engineering Lab
- Biointerfaces Lab
- Biomaterials Lab
- Center for Electrochemical Science and Engineering Lab
- Center of Excellence in Polymer Science and Engineering Lab
- Computational Fluid Dynamics Lab
- Fuel Cell Lab
- Fuel Cell Battery Lab
- Fluidization Lab
- Gas Processing Lab
- Interfacial Phenomena Lab
- Light Scattering Lab
- Multiphase Flow and Fluidization Lab
- Particle Technology Lab
- Pharmaceutical and Crystallization Lab
- Polymer Characterization Lab
- Polymer Reaction Engineering Lab
- Porous Media and Core Analysis Lab
- Process Control & Optimization Lab
- Process Modeling, Monitoring and Control Lab
- Rheology Lab
- Riser Lab
- Solar Hydrogen Lab
- Solar/Photo Voltaic Lab

The computational facilities of the department include the Advanced Computer Laboratory, and the computer facilities of each research group. There are 26 Pentium-based computers in the PC lab that can access the workstations, creating a 26-seat computational lab for instructional activities at the graduate and undergraduate levels. All computers are connected to the IIT computer network by ethernet. Both the PCs and workstations access the multimedia system to provide data visualization and high-quality presentations. Each research lab also has specialized computer facilities. The computational capability for the department is provided by three servers that include both Linux and Windows. Students also have access to the universitys Computing and Network Services.

Research Areas

Faculty members conduct numerous projects in the departments core areas of research competency:

Energy and Sustainability

- Fuel Cells
- Fluidization and Gasification
- Hybrid Systems

Biological Engineering

- Molecular Modeling
- Diabetes
- Biomedical and Pharmaceutical Engineering

Advanced Materials

- Interfacial and Transport Phenomena
- Nanotechnology
- Polymers
- Biomaterials

Systems Engineering

- Complex Systems
- Advanced Process Control
- Process Monitoring

Faculty

Javad Abbasian (abbasian@iit.edu), GTI Associate Professor of Chemical Engineering. B.S., Abadan Institute of Technology (Iran); M.S., Ph.D., Illinois Institute of Technology. Research interests: High temperature gas cleaning, pollution control and solid waste management; gas separation and purification; and process design and development.

Hamid Arastoopour (arastoopour@iit.edu), Henry R. Linden Professor of Energy and Director of WISER. B.S., Abadan Institute of Technology (Iran); M.S., Ph.D., Illinois Institute of Technology. Research interests: Computational fluid dynamics (CFD) of multiphase flow, fluidization, flow in porous media, particle technology and material processing, and environmental engineering problems.

Donald J. Chmielewski (chmielewski@iit.edu), Associate Professor of Chemical Engineering and Associate Chair, Graduate Affairs. B.S., Illinois Institute of Technology; M.S., Ph.D., University of CaliforniaLos Angeles. Research interests: Advanced process control; fuel cell system design and control.

Ali Cinar (cinar@iit.edu), Professor of Chemical Engineering, Dean of the Graduate College and Associate Vice President for Research. B.S., Robert College (Turkey); M.S., Ph.D., Texas A&M. Research interests: Fundamental methodology and tools used in various applications including: polymer reaction engineering, food processing, medicine and biotechnology.

Dimitri Gidaspow (gidaspow@iit.edu), Professor Emeritus. B.S., City College of New York; M.S., Polytechnic Institute of Brooklyn; Ph.D., Illinois Institute of Technology. Research interests: Hydrodynamic theories of fluidization and multiphase flow, gas-solid transport, and hydrodynamic models for slurry bubble column reactors.

Nancy W. Karuri (nkaruri1@iit.edu), Assistant Professor of Chemical Engineering. B. E., University of New South Wales, Australia; Ph.D., University of Wisconsin-Madison. Research Interests: tissue engineering, biomimetic scaffolds, extracellular matrix assembly.

Satish Parulekar (parulekar@iit.edu), Professor of Chemical Engineering. B.S., University of Bombay; M.S., University of Pittsburgh; Ph.D., Purdue University. Research interests: Biochemical engineering and chemical reaction engineering.

Victor H. Prez-Luna (perezluna@iit.edu), Associate Professor of Chemical Engineering. B.S., M.S. Universidad de Guadalajara (Mexico); Ph.D., University of Washington. Research interests: Surface analysis and modification, biomaterials and biosensors, and tissue engineering

Jai Prakash (prakash@iit.edu), Interim Chair,Professor of Chemical Engineering, Director, Center for Electrochemical Science and Engineering and Interim Chairman. B.S., M.S., Ph.D., University of Delhi; Ph.D., Case Western Reserve University. Research interests: Electrochemistry, materials development, and batteries and fuel cells.

Vijay K. Ramani (ramani@iit.edu) Assistant Professor of Chemical Engineering. B.E. Annamalai University (India); Ph.D., University of Connecticut. Research interests: Hybrid materials for sustainable chemical and electrochemical energy conversion, hydrogen and liquid fueled polymer electrolyte fuel cells (PEFCs), degradation mitigation strategies in PEFCs, and development of educational modules to demonstrate sustainable energy economy concepts.

Jay D. Schieber (schieber@iit.edu), Professor of Chemical Engineering. B.S., University of Illinois-Urbana; Ph.D., University of Wisconsin, Madison. Research interests: Kinetic theory, polymer rheology predictions, and thermal conductivity measurements.

Fouad A. Teymour (teymour@iit.edu), Johnson Polymer Professor of Chemical Engineering. B.S., M.S., Cairo University; Ph.D., University of Wisconsin-Madison. Research interests: Polymer reaction engineering, mathematical modeling, nonlinear dynamics, and complexity and complex systems.

David C. Venerus (venerus@iit.edu), Hyosung S.R. Cho Professor of Chemical and Biological Engineering and Director, Center of Excellence in Polymer Science and Engineering. B.S., University of Rhode Island; M.S., Ph.D., Pennsylvania State University. Research interests: Transport phenomena in complex materials, Forced Rayleigh Scattering, polymer rheology, and polymer foam processing.

Darsh T. Wasan (wasan@iit.edu), Motorola Chair Professor of Chemical Engineering and Vice President of International Affairs. B.S., University of Illinois, Urbana-Champaign; Ph.D., University of California, Berkeley. Research interests: Thin liquid films, foams, emulsions and nano-particle suspensions, film rheology and applications, wetting, spreading and adhesion of nano-fluids on solid surfaces, environmental technologies, food colloids.

Research Faculty

Nader Aderangi (aderangi@iit.edu), Lecturer in Chemical Engineering and Director of Undergaduate Department Laboratories. B.S., University of Tehran; M.S., University of Colorado; Ph.D., Illinois Institute of Technology. Research interests: Unit operations, chemical processes, interfacial mass transfer, rheological properties.

Alex Nikolov (nikolov@iit.edu) Research Professor of Chemical Engineering. B.S., Ph.D., University of Sofia (Bulgaria). Research interests: Interfacial rheology, foams, emulsion, dispersion, and thin liquid films.

Bert Plomp (l.plomp@ecn.nl) Research Professor of Chemical Engineering and Project Manager Supercapacitors, Energy Research Centre of the Netherlands ECN. Ing. Electrical Engineering and Information Technology, Ir. Applied Physics Delft University of Technology (Netherlands); Dr. Physical Chemistry, Free University of Amsterdam (Netherlands) Research interests: Fuel cells and supercapacitors.

J. Robert Selman (selman@iit.edu), IIT Distinguished Research Professor of Chemical Engineering. Ing., Technical University (Netherlands); M.S., University of Wisconsin-Madison; Ph.D., University of California, Berkeley. Research interests: Fuel cell and battery design and operation; high-temperature fuel cells; lithium battery design and thermal management.

Yang-Kook Sun (ysun5@iit.edu) Research Professor of Chemical Engineering. M.S., Ph.D. Seoul National University. Research interests: Lithium batteries, hybrid electrochemical capacitors with high power and high capacitor, solid oxide fuel cell.

Adjunct Faculty

Robert Anderson, Master of Management, Northwestern University.

Admission Requirements

Cumulative Undergraduate GPA: 3.0/4.0
GRE score minimum:
M.S./MAS: 900 (quantitative + verbal), 2.5 (analytical writing)
Ph.D.: 1000 (quantitative + verbal), 3.0 (analytical writing)
TOEFL minimum score: 550/213/80*

Note: The GRE requirement is waived for Professional Masters degree applicants who hold a Bachelor of Science in a related field from an ABET-accredited university in the United States, with a minimum cumulative GPA of 3.0/4.0

Certificate program applicants must possess a bachelors degree with a minimum cumulative GPA of 2.5 on a 4.0 scale. The GRE is not required.

Meeting the minimum GPA and test score requirements does not guarantee admission. Test scores and GPA are just two of several important factors considered. Admission to graduate study in chemical engineering, biological engineering, or gas engineering requires the completion of a program leading to a bachelors degree in chemical engineering or another engineering discipline from an accredited institution. Depending on the students background, additional deficiency courses, some of which may not count toward the degree, may be required. Please see the departments list of applicable undergraduate courses.

Admission to the graduate degree program in biological engineering requires one college-level semester of biology. Students not meeting this requirement may be admitted, but will have to take CHE 412 to remove the deficiency. Admission to graduate degree programs in food process engineering normally requires a bachelors degree in chemistry; biology; food science; chemical, agricultural, food or environmental engineering; or a related field. Depending on the students background, additional deficiency courses, some of which may not count toward the degree, may be required. Please see the departments list of applicable undergraduate courses.

* Paper-based test score/computer-based test score/internet-based test score.

Master of Biological Engineering

30 credit hours
No Thesis Requirement
The objective of this degree program is to prepare students for professional practice in any field of engineering involving heavy emphasis on biological processes, and to provide a foundation in the fundamental knowledge of biological engineering. The student must have a minimum grade point average of 3.0/4.0 in the core areas. Candidates are required to take a total of 30 credits, 9 credits for core courses, 7 credits of required biology courses, 2 credits of a required professional course, and 12 credits of electives chosen from the list below.

Core Courses

CHE 406 Transport Phenomena
CHE 503 Thermodynamics
CHE 577 Bioprocess Engineering

A minimum grade point average of 3.0/4.0 is required for core courses.

Biology requirement:

BIOL 504 Biochemistry Lectures
BIOL 515 Molecular Biology (after completing BIOL 504)

Professional requirement:

CHE 506 Entrepreneurship and Intellectual Property Management

Electives

BME 533 Biostatistics
BME 570 Engineering Biocompatible Materials
CHE 552 Bionanotechnology and Interfacial Phenomena
CHE 514 Process Analytical Technology
CHE 519 Biosensors
CHE 533 Statistical Analysis of Systems
CHE 545 Metabolic Engineering
CHE 573 Bioseparations
CHE 580 Biomaterials
CHE 583 Pharmaceutical Engineering
CHE 584 Tissue Engineering
BME 525 Concepts of Tissue Engineering
CHE 585 Drug Delivery
CHE 597 Research Project
ENVE 513 Biotechnological Processes in Environmental Engineering

Any 500 level Food Process Engineering course

Other approved electives from CHE, CHEM, BME, BIOL

Master of Chemical Engineering

30 credit hours
No Thesis Requirement
Project option

The objective of this degree program is to prepare students for professional practice in the field of chemical engineering, and to provide a foundation in the fundamental knowledge of chemical engineering. The student must have minimum grade point average of 3.0/4.0 in the core areas. Candidates are required to take a total of 30 credits, 12 credits for core courses, 2 credits of a required professional course, and 16 credits of electives. Elective courses are to be determined in consultation with academic advisor. The student must have minimum grade point average of 3.0/4.0 in the core areas.

Core courses:

CHE 406 Transport Phenomena
CHE 503 Thermodynamics
CHE 525 Chemical Reaction Engineering∗

AND one of the following:

CHE 535 Applications of Mathematics to Engineering
CHE 530 Advanced Process Control

A minimum grade point average of 3.0/4.0 is required for core courses.

*Note: Interested students can substitute, upon advisor consent, CHE 577: Bioprocess Engineering for CHE 525: Chemical Reaction Engineering.

Professional requirement:

CHE 506 Intellectual Property Management and Entrepreneurship

Master of Food Process Engineering

32 credit hours
Professional Non-Thesis

Admission Requirements for Master of Food Process Engineering

Cumulative undergraduate GPA minimum: 3.0/4.0
GRE 950 (quantitative + verbal) and 2.5 analytical writing†
TOEFL minimum: 550/213/80*

**Paper-based test score/computer-based test score/internet-based test score.*

†The GRE requirement is waived for applicants who hold a Bachelor of Science in a related field from an ABET-accredited university in the United States, with a minimum cumulative GPA of 3.0/4.0

Program Description

The Food Process Engineering (FPE) programs at NCFST are directed toward students with a background and career objectives in engineering related disciplines. GPA and test scores are just two of the several important factors considered. Admission to graduate study in food process engineering generally requires a Bachelors degree in chemical, agricultural, food or environmental engineering; food science; chemistry; biology; or a related field. Depending on the student's background, additional proficiency courses, some of which may not count toward the degree may be required. Please see the department's list of applicable undergraduate courses. Students in the Master of Food Process Engineering program are encouraged to complete an independent project and should consult with their NCFST, IIT faculty advisor to plan a program of study best suited to their background and interests. Candidates are required to take a total of 32 credit hours, 15-18 of which must be from the core courses listed below, 8 -11 credit hours must be selected from elective courses, and 5-6 credit hours must be selected from the Chemical and Biological Engineering Department Courses. Courses are offered at NCFST and via internet with the exception of FPE 506, FPE 593, FPE 594, and FPE 597.

Core Course Requirements

FPE 505 Food Microbiology
FPE 506 Food Microbiology Laboratory*
FPE 521 Food Process Engineering
FPE 522 Advanced Food Process Engineering
FPE 524 Fundamentals of Food Science and Technology
FPE 541 Principles of Food Packaging

* FPE 506 is required unless the student has enough professional experience to allow a substitute class, the decision will be made by the NCFST Program Director.

Proficiency Requirement

These courses may be required if the student has not taken an equivalent course at the undergraduate level:

CHE 406 Transport Phenomena
CHE 423 Chemical Reaction Engineering
CHE 435 Process Control

The student must have a minimum grade point average of 3.0/4.0 in the core areas. In addition to the core courses, coursework may be selected (with NCFST advisor approval) to satisfy the needs of the individual student or may be concentrated in one of the following areas of specialization:

- Process and product development
- Food processing operations
- Food Packaging
- Food Safety
- Food Biotechnology
- Process and quality monitoring and control

Required courses for these specializations are described in the course descriptions.

FPE Electives (8-11 credit hours)

Students must take at least two courses from the following group of food process engineering courses:

FPE 504 Food Biotechnology
FPE 507 Food Analysis
FPE 511 Food Law and Regulation
FPE 520 Low-Acid Canned Food Regulations and Microbiology
FPE 523 Food Engineering Process Delivery
FPE 526 Engineering Principles of Food
FPE 531 HACCP Planning and Implementation
FPE 593 Seminar Series
FPE 594 Special Projects
FPE 597 Special Problems

Students can enroll in FPE 594 and 597 with a maximum of 6 credit hours total between both courses with NCFST Advisor approval. However, when 597 is used as short course, the total credit hours must not exceed 8 credit between 594 and 597.

Students must take at least two courses from the following group of chemical and biological engineering courses:

FPE Elective Requirements (5-6 credit hours)

CHE 426 Statistical Tools for Engineers
CHE 439 Numerical Analysis
CHE 494 Chemical Process Design
CHE 560 Statistical Quality and Process Control
CHE 573 Bioseparations
CHE 577 Bioprocess Engineering
CHE 579 Enzyme Reactor Engineering
ENVE 513 Biotechnological Processes in Wastewater Treatment
ENVE 542 Environmental Unit Processes

Student may enroll in a ChBE course elective that is not listed above, with NCFST advisor approval.

Master of Science in Chemical Engineering

32 credit hours
Thesis

The objective of this degree program is to enable the student to build a strong foundation in multiple areas of chemical engineering and to specialize in one area via research and thesis. Candidates are required to take a total of 32 credit hours, 12 credits of which must be for the chemical engineering core courses listed below, and six to eight credit hours must be in research and thesis work. Elective courses are to be determined in consultation with academic advisor.

Core Courses

CHE 525 Chemical Reaction Engineering
CHE 535 Applications of Mathematics to Engineering
CHE 551 Advanced Transport Phenomena
CHE 553 Advanced Thermodynamics

Students can enroll in a ChBE course that may not be listed with the NCFST advisor approval. A minimum grade point average of 3.0/4.0 is required for core courses. Aside from the core courses, coursework may be selected (with advisor approval) to satisfy the needs of the individual student and may be aligned with the research areas listed in the Department of Chemical and Biological Engineering section of this bulletin.

A thesis may be completed outside the department only by special arrangement with the department chair. The successful M.S. degree candidate will complete a thesis based on research as well as an oral defense of the thesis, under the direction of the thesis examining committee.

Master of Science in Computer Science/Master of Chemical Engineering

44 credit hours
No thesis requirement

The objective of the program is to educate, and prepare for professional practice, process engineers with broad based knowledge of chemical engineering and computer science fundamentals, and computer scientists with strong engineering fundamentals. Candidates are required to take 18 credit hours in graduate chemical engineering courses (courses numbered 500 or higher) and 26 credit hours in computer science courses (of which 20 credit hours must be in courses numbered 500 or higher). The 18 credit hours in chemical engineering courses consist of 12 credit hours in core courses listed in the description of the Master of Science in Chemical Engineering requirements and six credit hours from the following courses:

CHE 507 Computer-Aided Design
CHE 508 Process Design and Optimization
CHE 528 Analysis and Simulation of Chemical Processing
CHE 532 Process Modeling
CHE 533 Statistical Analysis of Systems
CHE 536 Computational Techniques in Engineering
CHE 560 Statistical Quality and Process Control

Students should refer to the Department of Computer Science section of this bulletin for details on computer science course requirements for the dual degree.

Master of Science in Food Process Engineering

32 credit hours
Thesis and Oral Defense (written thesis report required)

Admission Requirements for Master of Science in Food Process Engineering
Cumulative undergraduate GPA minimum: 3.0/4.0
GRE 1100 (quantitative + verbal) and 2.5 analytical writing
TOEFL minimum: 550/213/80*

**Paper-based test score/computer-based test score/internet-based test score.*

Program Description
The Food Process Engineering (FPE) programs at NCFST are directed toward students with a background and career objectives in engineering related disciplines. GPA and test scores are just two of the several important factors considered. Admission to graduate study in food process engineering generally requires a Bachelors degree in chemical, agricultural, food or environmental engineering; food science; chemistry; biology; or a related field. Depending on the student's background, additional proficiency courses, some of which may not count toward the degree may be required. Please see the department's list of applicable undergraduate courses. Students in the Food Process Engineering programs should consult with their NCFST, IIT faculty advisor to plan a program of study best suited to their background and interests. Students enrolled in FPE Master of Science programs must register for six to eight credit hours of research. Research work will usually be conducted at the Moffett Campus; research topics will be selected from the food safety, food process engineering, food biotechnology, or related topics.

Candidates are required to take a total of 32 credit hours, 18 of which are the required courses listed below, a minimum of 6-8 credit hours in Research and Thesis, 5-6 credit hours must be taken from Chemical and Biological Engineering Department courses, and the remaining 1-3 credit hours can be taken from FPE electives, if needed. Courses are offered at NCFST and via the internet, with the exception of FPE 506, FPE 593, FPE 594, and FPE 597.

Core Course Requirements (18 credit hours)

FPE 505 Food Microbiology
FPE 506 Food Microbiology Laboratory
FPE 521 Food Process Engineering
FPE 522 Advanced Food Process Engineering
FPE 524 Fundamentals of Food Science and Technology
FPE 541 Principles of Food Packaging

Core Research Thesis Requirements (6-8 credit hours)
FPE 591 Research and Thesis

Research for the thesis must be carried out under the direct supervision of a participating faculty member. Based on the requirements of the research project, thesis committee members may be chosen from IIT faculty members from ChBE and various departments, NCFST/FDA scientists, and the food industry scientists. The final thesis examination consists of submission of a written thesis, followed by an oral presentation open to all NCFST staff and the university community. (A thesis may be completed outside the department only by special arrangement with the department chair. The final examination is normally oral, but may be written at the discretion of the thesis examining committee.)

As a part of the thesis, the student is expected to contribute to one or more high quality peer-reviewed journal article(s). The student is also encouraged to present the research at a national professional society meeting.

Master of Science in Food Process Engineering (continued)

Proficiency Requirement

These courses may be required if the student has not taken an equivalent course at the undergraduate level:

CHE 406 Transport Phenomena (3)
CHE 423 Chemical Reaction Engineering (3)
CHE 435 Process Control (3)

The student must have a minimum grade point average of 3.0/4.0 in the core areas. In addition to the core courses, coursework may be selected (with adviser approval) to satisfy the needs of the individual student or may be concentrated in one of the following areas of specialization:

- Food Processing Operations
- Food Packaging
- Food Safety
- Food Biotechnology
- Process and Quality Monitoring and Control

Elective Requirements (5-6 credit hours)

Students must take two courses from the following group of chemical and environmental engineering courses: (5-6 credit hours)

CHE 426 Statistical Tools for Engineers
CHE 439 Numerical Analysis
CHE 494 Chemical Process Design
CHE 560 Statistical Quality and Process Control
CHE 573 Bioseparations
CHE 577 Bioprocess Engineering
CHE 579 Enzyme Reactor Engineering
ENVE 513 Biotechnological Processes in Wastewater Treatment
ENVE 542 Environmental Unit Processes

AND

FPE Electives
(1-3 credit hours)

FPE 504 Food Biotechnology
FPE 507 Food Analysis
FPE 511 Food Law and Regulation
FPE 520 Low-Acid Canned Food Regulations and Microbiology
FPE 523 Food Engineering Process Delivery
FPE 526 Engineering Principles of Food
FPE 531 HACCP Planning and Implementation
FPE 593 Seminar Series
FPE 594 Special Projects
FPE 597 Special Problems

Student may enroll in a ChBE course that is not listed above, with NCFST advisor approval.

Doctor of Philosophy

84 credit hours
Qualifying exam
Comprehensive exam
Thesis proposal
Dissertation and oral defense

The doctorate degree in chemical engineering is awarded in recognition of mastery in chemical/biological engineering and upon demonstration of an ability to make substantial creative contributions to knowledge in chemical engineering. The recipients of these degrees will be capable of a continuing effort toward advancement of knowledge and achievement in research while pursuing an academic or industrial research career. Coursework must include 15 credits of core courses.

Core Courses

CHE 551 Advanced Transport Phenomena
CHE 553 Advanced Thermodynamics
CHE 525 Chemical Reaction Engineering
CHE 535 Applications of Mathematics to Engineering
CHE 530 Advanced Process Control or CHE 536 Computational Techniques in Engineering

A minimum grade point average of 3.0/4.0 is required in the core courses. Please refer to the credit requirements section at the front of this bulletin for additional details.

Students should consult the Transfer Credits section at the front of this bulletin for rules on how many credit hours may be transferred from another institution.

Students must pass a written qualifying examination within three semesters after they have been admitted to the Ph.D. program. The exam is diagnostic in nature, and the results of the exam will determine the student's potential for success in the Ph.D. program and recommendations for a future program of study. The examination will cover 4 core areas: thermodynamics, reaction engineering and kinetics, transport phenomena, process modeling and control.

The comprehensive examination is oral and may include a written exam based on the student's performance on the qualifying exam. The exam questions will be formulated by the members of the Ph.D. examining committee. The examination will also include oral presentation and discussion by the student of a journal article selected a priori by the examining committee. The exam must be conducted within a year following completion of the qualifying exam. The Ph.D. examining committee, which may be the same as the Ph.D. thesis committee, should be suggested by the adviser and approved by the chairperson at least three weeks prior to the examination.

The thesis proposal examination, which is diagnostic in nature, should be conducted after the comprehensive exam and at least one year before the final thesis defense. The exam will be oral and will be administered by the Ph.D. thesis committee.

Doctoral research can begin after admission to the Ph.D. program. However, the major portion of the research should not be started until the comprehensive examination is passed and the thesis proposal is approved by the committee. All research must be conducted under the supervision of a full-time department faculty member and in the laboratories of the university. Off-campus research is possible with the approval of the department chairperson. The preliminary thesis draft must meet the approval of all members of the examination committee. An oral examination in defense of the thesis is given as an open university seminar. The thesis defense must meet with the approval of the examination committee; if it does not, the committee has the authority to determine whether or not to grant a re-examination.

Certifcate Programs

The department offers 8 graduate certificate programs, with one available only via the Internet. These programs provide students with post-baccalaureate knowledge of an area of specialization within chemical. Students in these programs register as certificate students.

Certificate programs typically require a set of three to four courses that must be completed in three years with a minimum GPA of 3.0/4.0. (Note: Some courses may have prerequisites.) Students who are admitted to master's degree programs may apply coursework previously taken in a certificate program toward the requirements for the master's degree.

Biological Engineering

This program provides an introduction to the field of biological engineering and its application in biological, biomedical and environmental processes. Students must complete four courses (12 credits) to receive the certificate.

Required course

CHE 577 Bioprocess Engineering

AND at least three courses from the elective courses listed under the Master of Biological Engineering.

Current Energy Issues

This program explores issues related to the establishment of sustainable energy systems including energy/environment/economics, renewable energy, batteries and fuel cells. Students must complete 3 of the following 4 courses (9 credits) to receive the certificate.

Required Courses

At least three from the following:

CHE 517 Energy Utilization Technologies and Economics
CHE 541 Renewable Energy Technologies
CHE 543 Energy, Environment and Economics
CHE 565 Electrochemical Engineering

Food Process Engineering

This program provides an introduction to the field of food engineering, with applications of chemical engineering to food manufacturing and food safety. The program requires that a set of three to four courses must be completed within three years with a minimum GPA of 3.0/4.0. Courses are offered at NCFST and via the internet, with the exception of lab courses.

Required Courses

FPE 521 Food Process Engineering
FPE 522 Advanced Food Process Engineering

AND two courses from the following group:

CHE 518 Mass-Transfer (Prerequisite: CHE 302)
CHE 560 Statistical Quality and Process Control
CHE 573 Bioseparations
CHE 577 Bioprocess Engineering
FPE 504 Food Biotechnology
FPE 505 Food Microbiology
FPE 506 Food Microbiology Laboratory
FPE 507 Food Analysis
FPE 511 Food Law and Regulation
FPE 524 Fundamentals of Food Science and Technology
FPE 531 HACCP Planning and Implementation
FPE 541 Principles of Food Packaging

Food Processing Specialist

This program provides a broad working knowledge of technical elements of thermal processing systems (with understanding of alternative technologies) to qualify at an intermediate level as a recognized Food Processing Specialist. Students must complete four courses (12 credits) to receive the certificate. Students who are admitted to master's degree programs may apply coursework previously taken in a certificate program towards the requirements for a master's degree.

Required Courses

FPE 520 Low-Acid Canned Food Regulations and Microbiology
FPE 522 Advanced Food Process Engineering
FPE 523 Food Engineering Process Delivery
FPE 526 Engineering Principles of Food

Particle Processing

This program provides an introduction to the field of particle processing, specifically in fluidization and fluid/particle systems. Fundamentals of fluid/particle system design, computational multiphase approach to gas/particle systems and advanced measurement techniques are presented. Students must complete three courses (nine credits) to receive a certificate.

Required courses

At least one of the following courses:

CHE 542 Fluidization and Fluid/Particle Flow Systems
CHE 489 Design of Fluidized Beds and Fluid/Particle Systems

AND one/two of the following courses:

CHE 587 Particle Processing and Characterization
CHE 486 Applied Particle Technology
CHE 582 Interfacial Colloidal Phenomena
CHE 586 Particle Technology

Pharmaceutical Engineering

This program develops, expands and refines skills to advance the technology of prescription drug development and manufacturing. Fundamentals of pharmaceutical engineering, drug delivery systems and regulatory issues are presented. Students must complete four courses (12 credits) to receive a certificate.

Required courses

The following three courses:

CHE 583 Pharmaceutical Engineering
CHE 585 Drug Delivery Systems
CHE 511 Regulatory Issues in Pharmaceutical Processes

AND one of the following:

CHE 514 Process Analytical Technology
CHE 560 Statistical Quality and Process Control

Polymer Science and Engineering

This program introduces fundamentals of polymerization and polymer synthesis, polymer kinetics, polymer processing and characterizations. Students must take four courses (12 credits) to receive the certificate.

Required course

CHE 470 Introduction to Polymer Science and Engineering (Prerequisite for all other courses in this certificate program.)

AND any three of the following courses:

CHEM 535 Advanced Polymer Chemistry
CHE 538 Polymerization Reaction Engineering
CHEM 542 Characterization of Polymers (Same as MMAE 579)
CHE 555 Polymer Processing (Prerequisite: CHE 406)

Process Operations Management

This program introduces methodology and tools to improve the technical management of process operations including process modeling, simulation, monitoring, control and optimization. Students must take four courses (12 credits) to receive the certificate.

Required courses

At least one course from each of the following groups:

I

CHE 426 Statistical Tools for Engineers
CHE 533 Statistical Analysis of Systems
CHE 560 Statistical Quality and Process Control
CHE 761 Statistical Design of Experiments for Process Improvement

II

CHE 435 Process Control
CHE 437 Discrete Time Systems and Computer Control
CHE 530 Advanced Process Control (Prerequisite: CHE 435, CHE 437 or equivalent)

III

CHE 431 Artificial Intelligence Applications in Engineering
CHE 508 Process Design Optimization
CHE 528 Analysis and Simulation of Chemical Processing
CHE 532 Process Modeling

Course Descriptions

Numbers in parentheses respectively indicate class, lab and credit hours. Note: Core courses are available once per year. Other courses may be offered less frequently.

Chemical Engineering

CHE 503
Thermodynamics
Laws of thermodynamics applied to chemical and biological engineering problems, properties of real fluids, phase and chemical equilibria, applications to chemical and biological process and auxiliary equipment. Core course. Prerequisites: Undergraduate course in chemical thermodynamics.
(3-0-3)

CHE 505
Fluid Properties
Prediction and correlation of physical and transport properties using equations of state, thermodynamic relationships, phase and chemical equilibrium.
(3-0-3)

CHE 506
Entrepreneurship and Intellectual Property Management
This course aims to introduce and develop a number of diversified professional skills necessary for success in an engineering research and development environment. Selected topics covered in the areas of technology entrepreneurship, opportunity assessment, creativity and innovation, project management, management of organizational change, entrepreneurial leadership, and intellectual property management. Prerequisite: Graduate standing or consent of the instructor.
(2-0-2)

CHE 507
Computer-Aided Design
Computer process simulation to develop technically and economically optimum overall process designs. Simulation framework includes unit operation computations, physical property determinations, Newton- Raphson convergence procedures and simulation language. Prerequisite: Undergraduate course in process design.
(3-0-3)

CHE 508
Process Design Optimization
Organization of the design problem and application of single and multivariable search techniques using both analytical and numerical methods. Prerequisite: Undergraduate course in process design.
(3-0-3)

CHE 509
Advanced Topics in Reactor Engineering
Selected topics based on current research interests of the instructor. Typical examples are reactor stability analysis, diffusional effects in heterogeneous catalysis, catalyst and enzyme deactivation analysis, immobilized enzyme reaction systems, liquid-liquid or gas-liquid dispersed phase reactors, biological reactors for wastewater treatment, photochemical reactors, polymerization reactors and crystallization dynamics. Prerequisite: CHE 525 or instructor approval.
(3-0-3)

CHE 510
Fluid Dynamics
Cross listed with MMAE 510 Kinematics of fluid motion. Derivation of equations of motion and Navier-Stokes equations. Exact and approximate solution techniques. Boundary layer theory. Introduction to stability and turbulence. Prerequisite: Undergraduate course in transport phenomena.
(3-0-3)

CHE 511
Regulatory Issues in Pharmaceutical Processes
Legal and scientific issues in regulating the pharmaceutical and healthcare industrial sectors. Role of regulatory agencies; FDA and the Center for Drug Evaluation and Research. Definitions and standards: laws, regulations, policies, procedures. Manufacturing pharmaceutical drugs, devices, and components in compliance with regulations. Prerequisite: Graduate standing or consent of the instructor.
(3-0-3)

CHE 512
Heat Transfer
A survey course in conduction, convection and radiation. Problems in condensation and convection are solved with the use of fundamental laws of fluid dynamics. Finite difference and algebraic solutions for unsteady-state and heat-regenerator problems are covered. Prerequisite: CHE 406.
(3-0-3)

CHE 514
Process Analytical Technology
Provides an introduction to Process Analytical Technology (PAT) as a framework to enhance process understanding and assist in the development of reliable yet efficient pharmaceutical operations. The course is divided into four sections. Definition of critical performance attributes within the context of FDA regulations. Overview of analytic measurement methods, including at/in- or on-line measurement of chemical, physical and microbiological quantities. Mathematical description of common data analysis and chemometric methods, including statistical process monitoring, multivariate analysis and parameter estimation. Design of real-time decision systems, including feedback control of operations and risk-based analysis of final product quality (real-time release). Prerequisite: BS in engineering or equivalent.
(3-0-3)

CHE 515
Natural Gas Processing
Application of engineering principles to natural gas separation processes, including multi-stage separation, solvent extraction, adsorption, membrane separation, and supercritical extraction. Design and economic analysis of various gas treating processes such as natural gas dehydration, sweetening, and LNG processes, using commercially available process simulators. Prerequisite: CHE 505.
(3-0-3)

CHE 516
Gas Transmission and Distribution
Fundamentals of the subsonic compressible flow, flow in gas transmission distribution systems, gas measurement, storage and compression. Gas/liquid two-phase flow fundamentals. Gas transmission and distribution in pipeline network using commercially available process simulators. Prerequisite: Undergraduate course in transport phenomena.
(3-0-3)

CHE 517
Gas Utilization Technologies and Economics
Gas and electric energy markets structure, costs and load profiles; Concepts, benefits, and applications of gas for power generation, and integrated energy systems for combined cooling, heating and power (CHP); Power generation technologies of engines, turbines, microturbines, and fuel cells; Thermally-activated technologies, of absorption chillers, desiccant dehumidifiers, and steam turbines; Economics; Case studies; Software tools. Prerequisite: Undergraduate course in transport phenomena.
(3-0-3)

CHE 518
Mass Transfer
Principles of diffusion, both steady and unsteady state, as applied to heat transfer, gas absorption, distillation, drying and extraction. Prerequisite: Undergraduate course in transport phenomena.
(3-0-3)

CHE 519
Biosensors
Engineering Principles used for the detection of biomolecules and cells in the context of biomedical, environmental, biochemical process applications. Immobilization of biological receptors for interfacing biomolecules with a transducer. Specific and non-specific interactions with surfaces. Transduction mechanisms for signal detection. Signal analyte and multiple analyte detection. Nanotechnology and biosensors.
(3-0-3)

CHE 520
LNG Fundamentals and Technologies
Properties and phase equilibria of Natural Gas liquid and gas mixtures at low temperatures. Thermodynamic analysis and design of natural gas liquefaction processes. Recent advances in LNG processing, storage and transportation. Prerequisites: CHE 505
(3-0-3)

CHE 522
Fundamentals of Combustion
Fundamentals of Combustion Thermodynamics of combustion. Combustion reaction kinetics. Combustion of Gaseous and vaporized fuels. Adiabatic flame temperature. Transport processes. Gas flames classification. Premixed flames. Diffusion flames. Laminar and turbulent regimes. Flame propagation. Gas fired furnace combustion. Detonation of Gaseous mixtures. Environmental issues and greenhouse effect. Environmental control technologies. Hydrogen as a fuel.
(3-0-3)

CHE 523
Fundamentals of Heterogeneous Catalysis
Fundamental principles governing heterogeneous catalysis, including chemical reaction equilibria, kinetics of gas-surface interactions and surface chemistry. Application of these fundamental principles to catalysis by metals and to acid catalysis. Discussion of several examples of reactions of technological interest. Prerequisites: Undergraduate courses in reaction engineering and thermodynamics.
(3-0-3)

CHE 524
Industrial Catalysis
A comprehensive state-of-the-art introduction to catalytic processes and catalysts used in the chemical and petroleum industries. Prerequisite: Basic background in organic, inorganic and physical chemistry.
(3-0-3)

CHE 525
Chemical Reaction Engineering
Advanced treatment of chemical kinetics and reactor systems including non-isothermal, non-ideal flow systems. Modeling of complex reactions, catalysis and heterogeneous reactor analysis. Reactor stability concepts. Core course. Prerequisite: Undergraduate courses in reaction engineering.
(3-0-3)

CHE 527
Petrochemical Systems
This course will cover descriptions and evaluations of processes designed to manufacture petrochemicals. The source, availability and characterization of feedstock will also be discussed. Process design procedures particular to petrochemicals will be emphasized. Prerequisite: Undergraduate course in process design.
(3-0-3)

CHE 528
Analysis and Simulation of Chemical Processing
Introduction to techniques for computer- aided analysis of chemical processing systems. Study of process simulation computer systems. Prerequisites: Undergraduate courses in process modeling, numeric methods and process design.
(3-0-3)

CHE 529
Advanced Process Design of Chemical Processes
In depth treatment of topics on the chemical engineering design and operation of chemical processes. Selected process applications are emphasized. Prerequisites: Undergraduate course in process design.
(3-0-3)

CHE 530
Advanced Process Control
State space, transfer function and discrete-time representations of process systems. Control system design. Interaction assessment. Multivariable and model predictivecontrol techniques. Core course for Ph.D. Prerequisite: Undergraduate course in process control.
(3-0-3)

CHE 532
Process Modeling
Development of steady-state and dynamic models of various physical and chemical processes. Parameter identification and state-estimation techniques. Prerequisite: Undergraduate course in process modeling.
(3-0-3)

CHE 533
Statistical Analysis of Systems
Multivariate probability distributions. Inference about mean, variance. Multivariate linear regression and response surface analysis. Principal components analysis, factor analysis, canonical correlation analysis. Clustering, discrimination and classification. Selected advanced topics such as survey design, design of experimental techniques, statistical methods for discrete and binary variables, time series analysis, partial least squares techniques. Prerequisites: Undergraduate course in statistics.
(3-0-3)

CHE 535
Applications of Mathematics to Chemical Engineering
Mathematical techniques and their application to the analytical and numerical solution of chemical engineering problems. The analytical component includes review of linear algebra, as well as solution of ordinary, partial differential and integral equations. The numerical component includes iterative solution of algebraic equations, numerical analysis and solution of ordinary differential equations. Core course.
(3-0-3)

CHE 536
Computational Techniques in Engineering
Advanced mathematical techniques, numerical analysis, and solution to problems in transport phenomena, thermodynamics and reaction engineering. Review of iterative solution of algebraic equations. Nonlinear initial and boundary value problems for ordinary differential equations. Formulation and numerical solution of parabolic, elliptic and hyperbolic partial differential equations. Characteristics, formulation and numerical solution of integral equations. Solution of transient two-phase flow problems using CFD codes. Prerequisite: A familiarity with FORTRAN is desirable. Core course for Ph.D.
(3-0-3)

CHE 538
Polymerization Reaction Engineering
The engineering of reactors for the manufacture of synthetic polymeric materials, commercial processes for manufacture of polymers of many types, polymer chemistry and engineering reactor design. Prerequisite: Undergraduate course in reaction engineering.
(3-0-3)

CHE 540
Flow-Through Porous Media and Fundamentals of Reservoir Engineering
Introduction to structural geology and gas and oil formation. Reservoir rock and fluid properties. Darcys Law and applications. Single and multiphase flow in porous media. Fundamentals of enhanced oil recovery. Unconventional gas and petroleum reserves.
(3-0-3)

CHE 541
Renewable Energy Technologies
Topics related to renewable energy technologies including review of renewable energy sources (solar, wind, biomass, etc.), energy storage and conversion with emphasis on batteries and fuel cells, hydrogen as an energy carrier, and the hydrogen economy.
(3-0-3)

CHE 542
Fluidization and Gas-Solids Flow Systems
Fluidization phenomena (bubbling, slugging, elutriation and jets in fluidized beds). Multiphase flow approach to fluidization and gas/solids flow systems. Kinetic theory approach to fluid/particle flow systems. Analysis of flow of particles in pneumatic conveying lines (dilute flow) and stand pipe (dense flow). Hydrodynamic analysis of spouted and circulating fluidized beds. Examples from current literature on applications of multiphase flow. Prerequisites: CHE 501, CHE 535.
(3-0-3)

CHE 543
Energy, Environment and Economics
The linkage of energy, environmental and economic issues. The impact of energy supply and end use on human well-being and the ecosystem. A comprehensive approach to the resolution of resource, technical, economic, strategic, environmental, socio- and geopolitical problems of the energy industries. Pathways to a sustainable global energy system. Same as ENVE 544.
(3-0-3)

CHE 544
Kinetic Theory of Multiphase Flow
The classical theory of gases is applied to particulate flow and to fluidization by the introduction of a granular temperature concept. Equations of state for powders, viscosities of suspensions and Navier-Stokes-like equations of motion are derived. Applications to the design of industrial equipment, such as fluidized bed catalytic crackers, are shown using solutions of these equations with workstations.
(3-0-3)

CHE 545
Metabolic Engineering
Cellular metabolism, energetics and thermodynamics of cellular metabolism, regulation of metabolic pathways, metabolic flux analysis, metabolic control analysis, analysis of metabolic networks, synthesis and manipulations of metabolic pathways, applications case studies.
(3-0-3)

CHE 551
Advanced Transport Phenomena
Formulation, solution and interpretation of problems in momentum, energy and mass transport phenomena that occur in chemical and biological processes. Prerequisite: Undergraduate course in transport phenomena.
(3-0-3)

CHE 552
Bionanotechnology and Interfacial Phenomena
Bionanotechnology and Interfacial Phenomena The course will introduce the students to the interdisciplinary concept of bionanotechnology, where engineering at atomic and molecular scale is achieved via biological principles of self-assembly and self-organization. Structural and functional principles of bionanotechnology will be discussed with an emphasis on impact of biological nanoengineering or interfacial science.
(3-0-3)

CHE 553
Advanced Thermodynamics
Advanced thermodynamics for research-oriented graduate students. The course covers the fundamental postulates of thermodynamics and introductory statistical mechanics, with applications to pure fluids, fluid mixtures, elastic solids, surfaces and macromolecules. (3-0-3) Prerequisite: Undergraduate course in chemical thermodynamics including thermodynamics of single-component systems and mixtures.
(3-0-3)

CHE 555
Polymer Processing
Analysis of momentum, heat- and mass-transfer polymer processing operations. Polymer processes considered include extrusion, calendering, fiber spinning, injection molding and mixing. Prerequisite: Undergraduate course in transport phenomena.
(3-0-3)

CHE 560
Statistical Quality and Process Control
Basic theory, methods and techniques of on-line, feedback, quality-control systems for variable and attribute characteristics. Methods for improving the parameters of the production, diagnosis and adjustment processes so that quality loss is minimized. Same as MMAE 560.
(3-0-3)

CHE 561
Chemical Engineering Calculations
Comprehensive problems to give the student a higher degree of proficiency in analyzing and solving comprehensive problems and situations. Subject matter varies with the interest and background of the instructor.
(3-0-3)

CHE 563
Separation Processes
Application of chemical engineering principles to separation processes, including distillation, extraction, chromatographic separation, electrokinetic separation, membrane separation, supercritical extraction, crystallization, foam fractionation and solubilization and coacervation. Prerequisites: Undergraduate course in transport phenomena and thermodynamics.
(3-0-3)

CHE 565
Fundamentals of Electrochemistry
Thermodynamics and potential, Marcus theory, charge transfer kinetics and mass transport of simple systems. Electrode reactions coupled with homogeneous chemical reactions. Double-layer structure and adsorbed intermediates in electrode processes. Potential step and potential sweep methods.
(3-0-3)

CHE 566
Electrochemical Engineering
Basic concepts of electrochemistry used in electrochemical reactor analysis and design. Electrolytic mass transfer, current and potential distribution, corrosion engineering. Electrodeposition. Batteries and fuel cells. Industrial electrolysis and electrosynthesis.
(3-0-3)

CHE 573
Bioseparations
Recovery of particulates (cells and other solids), chromatographic separations and applications, membrane separations, electrophoresis, recycle and immobilization, economics of bioseparations.
(3-0-3)

CHE 575
Polymer Rheology
Flow of viscoelastic fluids, integral and differential constitutive equations from continuum and molecular considerations, methods of experimental evaluations. Prerequisite: CHE 406.
(3-0-3)

CHE 576
Industrial Chemistry: Catalytic and Thermal Reactions and Processes
Includes petroleum refining, gasoline and alternative fuels, petrochemicals, such as polymers and polymer intermediates for films, fibers, elastomers and thermosets; surfactants, adhesives, lubes and gasoline additives; paper, wood, pesticides, pharmaceutical and biotechnology; sulfuric acid and derivatives, fertilizers, ceramics, glasses and other aspects of materials science.
(3-0-3)

CHE 577
Bioprocess Engineering
Application of engineering principles to the biological production processes. Enzyme kinetics, cell culture kinetics, transport phenomena in cells, membranes, and biological reactors, genetics, bioseparation and downstream processing, energetics of metabolic pathways, operation modes of cell cultures, mixed cultures and their applications.
(3-0-3)

CHE 579
Enzyme Reactor Engineering
The biochemical structure of proteins (enzymes), enzyme kinetics, methods of enzyme production and purification and methods of enzyme immobilization are discussed. Fundamentals of reactor design with emphasis on diffusional influences in heterogeneous systems are developed to permit analysis of novel immobilized enzyme processes. Prerequisite: Undergraduate course in reaction engineering.
(3-0-3)

CHE 580
Biomaterials
Metal, ceramic, and polymeric implant materials. Structure-property relationships for biomaterials. Interactions of biomaterials with tissue. Selection and design of materials for medical implants.
(3-0-3)

CHE 581
Processing and Applications of Polymer Composite Materials
Types, multiphase structures, classification, processing. Different moldings, foamed and cellular composites, cellular structure, types of foams. Applications.
(3-0-3)

CHE 582
Interfacial and Colloidal Phenomena with Applications
Applications of the basic principles of physical chemistry, surfactants and interfacial phenomena, surface and interfacial tension, adsorption of surfactants from solutions, spreading, contact angles, wetting, electrokinetic phenomena, rheology, dynamic interfacial properties, mass transport across interfaces. Applications include emulsions, foams, dispersions, tribology, detergency, flotation, enhanced oil recovery, suspension, emulsion polymerization and liquid membranes. Prerequisites: Undergraduate course in transport phenomena and thermodynamics.
(3-0-3)

CHE 583
Pharmaceutical Engineering
Application of transport phenomena, and reaction engineering to pharmaceutical processes. Heat and mass transfer in bioreactors and the fluidized beds. Drying, coating and granulation. Environmental and economical issues in the pharmaceutical processes. Examples from industrial processes and current literature.
(3-0-3)

CHE 584
Tissue Engineering
Growth and differentiation of cells and tissue. In vitro control of tissue development. In vivo synthesis of tissues and organs. Transplantation of engineered cells and tissue. Techniques and clinical applications of tissue engineering.
(3-0-3)

CHE 585
Drug Delivery
Principle of diffusion in liquid membranes and polymers, and methods for measurement and analysis of diffusion coefficient. Principle of molecular transport in polymeric material, and drug solubility in polymers. Intravenous infusion, and polymer drug delivery systems. Process involved and kinetics of solute release. Design and optimization of drug delivery systems based on pharmacokinetic/pharmacodynamic requirements.
(3-0-3)

CHE 586
Particulate Technology
Advances in applied particulate technology. Current specialized topics in systems such as powders, emulsions, suspensions, dusts and mists.
(3-0-3)

CHE 587
Particle Processing and Characterization
Particle rheology, particle size and distribution measurements, pulverization and attrition processes, agglomeration and materials processing.
(3-0-3)

CHE 591
Research and Thesis for M.S. Degree

CHE 593
Seminar in Chemical Engineering
Presentations on recent developments in the field by academic and industrial visitors.
(1-0-1)

CHE 594
Special Projects
Advanced projects involving computer simulation, modeling or laboratory work.
(Credit: 16 credit hours)

CHE 597
Special Problems
Independent study and project.
(Credit: Variable)

CHE 691
Research and Thesis for Ph.D. Degrees

CHE 701
Computer-Aided Process Design and Optimization
Process design, steady-state and dynamic process simulation and process optimization using commercial software for computer-aided process design and optimization. Prerequisites: CHE 494 or consent of instructor.
(2-0-2)

CHE 703
Computer Aided Process Modeling
Computer-aided modeling of lumped and distributed parameter systems of process models. Numerical algorithms for solving the resultant differential equations. Nonlinear parameters estimations from single and multi-response data, optimal experimental design and model discrimination.
(2-0-2)

CHE 761
Statistical Design of Experiments for Process Improvement
Full and fractional factorial designs of experiments, optimal designs, interactions, analysis of variance, empirical modeling and regression analysis, response surface analysis, process improvement by Taguchi methods and alternative designs of experiments. Prerequisite: Consent of instructor.
(2-0-2)

CHE 771
Applications of Enzymes and Microbes in Food Processing
Kinetics of enzyme-catalyzed reactions, applied enzyme catalysis in the food industry, stoichiometry of cell growth and product formation, carbon metabolism pathways, fermentation technology, applications of mixed cultures in the food industry, case studies. Prerequisite: CHE 411 or consent of instructor.
(2-0-2)

Food Process Engineering

FPE 504
Food Biotechnology
Introduction of biotechnology in the food industry including genetic engineering of microorganisms. Fundamentals of microbial genomics and proteomics. Practice of a variety of software and bioinformatics tools including database search, sequence alignment, phylogenetic and cluster analyses, gene prediction, genomic map construction, structural and functional prediction of proteins. Applications of DNA fingerprinting techniques in food safety and public health. Prerequisite: Biology or Microbiology.
(3-0-3)

FPE 505
Food Microbiology
Microorganisms of importance to food safety, spoilage and food fermentations. Principles of occurrence and control. Importance of sanitation and prevention of public health problems. Microbiological contaminants and methods for their detection. Mechanisms of microbial inactivation. Prerequisites: Introductory Microbiology, Food Science and Biochemistry
(3-0-3)

FPE 506
Food Microbiological Laboratory
Basic microbiological techniques and safe laboratory practices. Introductory Food Microbiology. Isolation of pathogenic bacteria. Spoilage microorganisms. Fermentation. Environmental Monitoring. Rapid Identification tests. Sporeformers. Prerequisites: Introductory Microbiology and Biochemistry
(3-0-3)

FPE 507
Food Analysis
Techniques for analyzing food toxins, food constituents of public health concern, intentional and unintentional food additives, modern separation and analytical techniques. Prerequisites: chemistry, analytical chemistry.
(3-0-3)

FPE 511
Food Law and Regulation
Legal and scientific issues in regulating the nations food supply and nutritional status. Rules of regulatory agencies; Federal Food, Drug and Cosmetic Act; definitions and standards for food and adulterated foods. Manufacturing processed foods in compliance with regulations.
(3-0-3)

FPE 520
Low-Acid Canned Food Regulations and Microbiology
Regulatory requirements for the U.S. Food and Drug Administration, and the broad microbial issues associated with low acid canned food (LACF) products. Topics will include the U.S. Food Drug & Cosmetic (FD&C) Act, Emergency Permit Control, 21 Code of Federal Register (CFR) parts 108, 113, and 114, record requirements, sources of microbial contamination, characteristics of Clostridium botulinum, mesophilic spore formers, indicator organisms, and introduction to microbial heat resistance. Prequisite: Consent of instructor.
(3-0-3)

FPE 521
Food Process Engineering
Food engineering fundamentals, heat transfer in food processing, food rheology, freezing of foods, food dehydration, kinetics of chemical reactions in foods, refrigeration and thermal process calculations, alternative methods of food processing.
(3-0-3)

FPE 522
Advanced Food Process Engineering
Process calculations for food processing methods such as canning, aseptic processing, ohmic heating, microwave processing and pulsed energy processing. Extrusion techniques in food processing. Discussion of new food processing techniques and safety implications. Prerequisite: FST 521 or permission of the instructor.
(3-0-3)

FPE 523
Food Engineering Process Delivery
Requirements for the U.S. Food and Drug Administration food canning regulations, including system design, process establishment, operation, and inspection records. Operations and calibration requirements of thermal processing equipment. Process design, documentation of process deviation and calculation of process delivery. Prequisite: Consent of instructor.
(3-0-3)

FPE 524
Fundamentals of Food Science and Technology
This course will cover the central food science issues encountered with storage and processing of all major American food commodities including meats, grains, confections, vegetables, eggs, dairy. It will also review the relevant chemistry, physics and engineering required to understand common food-related unit operations such as drying, freezing, sterilization and radiation treatment of foods. An introduction to microbial and chemical issues of food quality and safety will also be covered.
(3-0-3)

FPE 526
Engineering Principles of Food
Methods for conducting seal integrity examinations, spoilage diagnosis, and traceability, defining and classifying package defects. Types of packaging materials, including metal, glass, plastics, flexible and composite containers, and their closure and sealing systems. Aseptic and alternative process delivery systems. Prequisite: Consent of instructor.
(3-0-3)

FPE 531
HACCP Planning and Implementation
Examination of the hazard analysis and critical control point (HACCP) principles; microbiological and process overviews; generic HACCP models, good manufacturing practices; monitoring of critical control points, process control and implementation.
(3-0-3)

FPE 541
Principles of Food Packaging
Type and application of packaging materials. Migration Theories. Food Package interaction. Package testing to ensure safety. Special design considerations. Recycling of package materials.
(3-0-3)

FPE 591
Research and Thesis
Students conduct their research on a particular topic and write a thesis. Students are also required to write manuscripts from his/her thesis work for publication. Prequisite: Consent of instructor.
(Credit: 6-8 hours)

FPE 593
Seminar on Food Safety and Technology
Students attend seminars offered during the semester. Each student is also required to give a 30 minute presentation on a topic of his/her interest or a research project on which she/he has worked.
(Credit : 1 hour)

FPE 594
Special Projects
Advanced projects involving analysis of food safety processing, packaging and biotechnology systems. Prequisite: NCFST advisor approval.
(Credit: 1-6 hours)

FPE 597
Special Problems
Independent study focusing on current problems, issues of professional relevance. Topics selected from food process engineering, food safety, packaging, biotechnology. Repeatable to a maximum of six credit hours. Prequisite: NCFST advisor approval.
(Credit: 1-6 hours)

Undergraduate Courses Available to Graduate Students

With the approval of their advisors, students in the chemical and biological graduate programs may apply up to 12 credits hours to their program from 400-level undergraduate courses. This does not apply to students pursuing the dual masters degree in chemical engineering and computer science.

Chicago-Kent College of Law

565 W. Adams St.
Chicago, IL 60661
312.906.5000
admissions@kentlaw.edu
www.kentlaw.edu

Dean:
Harold J. Krent

Chicago-Kent College of Law is accredited by the American Bar Association and is a member of the Association of American Law Schools and the Order of the Coif. The law school is housed in a state-of-the-art, 10-story facility in the West Loop area of downtown Chicago. The building is a short walk from the Federal Building that houses the U.S. District Court, the U.S. Court of Appeals, and numerous federal agencies; the Daley Center, where the Illinois state courts sit; and LaSalle Street, the hub of law practice in Chicago. Being located in the heart of one of the major legal centers in the United States enables the law school to supplement its distinguished full-time faculty with outstanding practitioners and jurists who teach courses in their areas of expertise.

Degrees Offered

Juris Doctor (J.D.)

Master of Laws (LL.M.)

Joint-Degree Programs

J.D./LL.M. in Family Law
J.D./LL.M. in Financial Services Law
J.D./LL.M. in Taxation

With Stuart School of Business:
J.D./M.B.A.
J.D./M.P.A.
J.D./M.S. in Environmental Management and Sustainability
J.D./M.S. in Finance

With University of Illinois at Chicago:
J.D./Master of Public Health (M.P.H.)

Certificate Programs

To earn certificates, students must be admitted and enrolled as law students in the J.D. program.

Criminal Litigation
Environmental and Energy Law
Intellectual Property Law
International and Comparative Law
Labor and Employment Law
Litigation and Alternative Dispute Resolution
Public Interest Law

Research Centers

Center for Access to Justice and Technology

Chicago-Kent College of Law established the Center for Access to Justice and Technology (CAJT) to make justice more accessible to the public by promoting the use of the Internet in the teaching, practice and public access to the law. The one focus of CAJT is to help pro se litigants obtain greater access to justice. Many self-represented litigants, even in simple cases, struggle to navigate through an unfamiliar and procedurally complex court system. The Center conducts research, builds software tools, teaches classes, and supports faculty, staff and student projects on access to justice and technology.

Center for Open Government

The Center for Open Government is an initiative to help ensure transparency, accountability and responsibility in state and local government. Housed in the Chicago-Kent Law Offices as part of the law school's clinical education program, the Center for Open Government focuses on pro bono cases challenging closed government processes under the Illinois Open Meetings Act, the Illinois Freedom of Information Act, and similar statutes. Under the supervision of faculty, Chicago-Kent students interview and counsel clients, conduct factual investigations and legal research, develop case strategies, collect and analyze documents, and help with litigation.

Global Law and Policy Initiative

The Global Law and Policy Initiative (GLAPI) aims to develop a better understanding of the evolving global environment and to strengthen democratic institutions wherever they may be found. It brings together the Chicago-Kent faculty, the Chicago community and Chicago-Kent students who have an active interest in broadening their involvement in international law. In addition, GLAPI provides a forum to promote the exchange of views and experiences among academics, policymakers and business leaders about critical issues of global policy. GLAPI-sponsored dialogues cover a wide range of topics, including the rule of law, international policing, anti-corruption strategies, economic development, technology and human rights.

Institute for Law and the Humanities

The Institute for Law and the Humanities was created to facilitate, support and encourage symposiums, lectures, scholarship and faculty discussion on the relationship between law and other humanistic disciplines. It provides opportunities for faculty and students to integrate humanities-based studies with the study of law and explore the increasingly rich and diverse scholarship in areas such as legal philosophy, legal history, law and literature, and law and religion.

Institute for Law and the Workplace

The Institute for Law and the Workplace is a national center for research, training, dialogue and reflection on the law that governs the workplace. The Institute pools the resources of leading scholars and the practicing professional community to train students and professionals, monitor policies and trends, and reflect upon major issues in a neutral setting.

Institute for Science, Law and Technology

The Institute for Science, Law and Technology is a joint venture of the academic units of IIT designed to meet the growing need for science- and law-trained professionals capable of addressing the complex issues that arise in a global, technologically driven marketplace of ideas, product standards, and conflicts. The most difficult challenges at the intersection of law and science today arise from new technologies. New possibilities in biotechnology, such as cloning and genetic engineering, raise difficult questions about ethics and challenge traditional legal concepts. Environmental concerns about the generation of greenhouse gases, rain forest devastation and sustainable development challenge public policy. The Internet and other new information networks escape legal control at national boundaries. The Institute serves as a cross-disciplinary forum for lawyers, scientists, ethicists, psychologists, businesspeople, designers and engineers to confront the challenges presented by new technologies.

Research and Training Facilities

The Downtown Campus Library

The Downtown Campus Library contains more than 500,000 volumes and supports the Chicago-Kent College of Law, the Stuart School of Business, and the Public Administration programs. A special collection known as the Library of International Relations contains a diverse collection of international reference materials in law, business, economics and history, as well as important collections of documents from a wide variety of international organizations. The library, which is both wired and wireless, seats more than 450 people and contains computer classrooms, copier rooms and nine reservable rooms for group study. Seating throughout the library provides access to all of the network computer facilities, including online research systems both remote (e.g., LexisNexis, Westlaw, and numerous other subscription databases in law and business) and internal, such as Web-based interactive tutorials, computer-assisted legal instruction, productivity tools and e-mail.

Computer Facilities

Chicago-Kent boasts a computer network that is among the most technologically advanced of any law school in the nation. Wireless technology allows complete access to the network and is available throughout much of the building, including the atrium area that spans the concourse, first and second floors; all floors of the library; many classrooms; and the student lounge. Students with laptops can also use network ports available almost everywhere in the building. Every seat in the library and almost every classroom seat has a hardwired computer node with adjacent power connections. Networked workstations are devoted to student use throughout the building in three computer labs as well as in student lounges, the library, and even the cafeteria and atrium. Web-based student resources, including online registration and grading systems, are available 24/7 from anywhere with an Internet connection. Faculty members routinely prepare interactive tutorials that can be accessed by students ahead of class.

The Judge Abraham Lincoln Marovitz Courtroom

The Judge Abraham Lincoln Marovitz Courtroom, named for the late distinguished Chicago-Kent graduate and senior judge of the U.S. District Court for the Northern District of Illinois, integrates design features from the best courtrooms and trial advocacy training facilities in the nation. Planned for both law school instruction and actual legal proceedings, the Marovitz Courtroom incorporates the latest computer and audiovisual technology in a traditional setting.

Research and Clinical Training Areas

Legal Research and Writing

Chicago-Kent has one of the most rigorous and comprehensive legal research and writing programs in the country. The required five-course curriculum introduces students to basic and advanced research techniques; memorandum and brief writing; transactional writing and client representation; and specialized research and writing in such areas as securities, labor and employment, environmental, international, public interest, or intellectual property law.

Clinical Education

The Law Offices of Chicago-Kent, a teaching law office located in the law school, is one of the largest in-house clinical programs in the United States. The center is staffed by more than a dozen full-time attorneys and serves more than 1,000 clients each year. Students who intern in the law offices have the opportunity to work on cases in a wide variety of clinical practice areas—civil practice, criminal law, environmental law, family law, health and disability law, immigration law, intellectual property law, mediation, and tax law—under the supervision of a clinical professor. Other skills training opportunities are available through the Judicial and Advanced Externship programs. Students in the Judicial Externship Program are placed with participating judges in the federal district, appellate and bankruptcy courts. Judicial externs work directly with the judge and the judge's senior law clerk and perform the same duties as the law clerk, including researching, writing memoranda of law, drafting opinions, and generally observing and participating in the day-to-day operation of the court. Those selected for the Advanced Externship Program work with teaching attorneys in a wide range of government and private practice settings.

Faculty

Visit the Chicago-Kent Web site for detailed faculty biographies (www.kentlaw.edu/faculty).

Susan Johanne Adams, Professor of Legal Research and Writing, Associate Director of the Legal Research and Writing Program, and Director of Writing Services. B.A., M.A., University of Wisconsin; J.D., Valparaiso University School of Law.

Lori B. Andrews, Distinguished Professor of Law, Director of the Institute for Science, Law and Technology, and Associate Vice President. B.A., Yale College; J.D., Yale Law School.

Bernadette Atuahene, Assistant Professor of Law. B.A., University of California, Los Angeles; M.P.A., Harvard University; J.D., Yale Law School.

Kimberly D. Bailey, Assistant Professor of Law. B.A., Indiana University Bloomington; J.D., University of Michigan Law School.

Katharine K. Baker, Professor of Law. B.A., Harvard-Radcliffe College; J.D., University of Chicago Law School.

Felice Batlan, Assistant Professor of Law and Co-Director of the Institute for Law and the Humanities. B.A., Smith College; J.D., Harvard Law School; Ph.D., New York University.

William A. Birdthistle, Assistant Professor of Law. B.A., Duke University; J.D., Harvard Law School.

Fred P. Bosselman, Professor of Law Emeritus. A.B., University of Colorado; J.D., Harvard Law School.

Ralph L. Brill, Professor of Law. A.B., J.D., University of Illinois, Urbana-Champaign.

Evelyn Brody, Professor of Law. B.A., Yale University; J.D., Georgetown University Law Center.

Bartram S. Brown, Professor of Law and Co-Director of the Program in International and Comparative Law. B.A., Harvard University; J.D., Columbia University; Ph.D., Graduate Institute of International Studies (Switzerland).

Gerald Brown, Director of the Graduate Program in Taxation and Senior Instructor. B.S.C., DePaul University; J.D., University of Chicago.

Christopher J. Buccafusco, Assistant Professor of Law. B.S., Georgia Institute of Technology; J.D., University of Georgia School of Law.

Howard S. Chapman, Professor of Law. B.S., J.D., University of Illinois, Urbana-Champaign.

Sungjoon Cho, Associate Professor of Law. LL.B., M.P.A., Seoul National University; LL.M., University of Michigan Law School; S.J.D., Harvard Law School.

Lewis Collens, President Emeritus of Illinois Institute of Technology and Professor of Law Emeritus. B.A., M.A., University of Illinois, Urbana-Champaign; J.D., University of Chicago.

Richard J. Conviser, Professor of Law. B.A., J.D., University of California, Berkeley; Dr. Jur., University of Cologne (Germany).

Daniel T. Coyne, Clinical Professor of Law. B.A., University of Illinois, Chicago; J.D., The John Marshall Law School.

Elizabeth De Armond, Associate Professor of Legal Research and Writing. B.S., Georgia Institute of Technology; J.D., University of Notre Dame Law School; LL.M., Harvard Law School.

Jonathan P. Decatorsmith, Assistant Professor of Clinical Practice. B.A., University of Illinois, Urbana-Champaign; J.D., University of Colorado.

Rhonda E. de Freitas, Assistant Clinical Professor of Law. B.A., Florida International University; J.D., Loyola University Chicago School of Law.

Howard C. Eglit, Professor of Law. B.A., University of Michigan; J.D., University of Chicago.

Suzanne Ehrenberg, Professor of Legal Research and Writing. B.A., Williams College; J.D., University of Chicago Law School.

Hon. David A. Erickson, Director of the Trial Advocacy Program, Director of the Program in Criminal Litigation and Senior Instructor. B.A., Northern Illinois University; J.D., The John Marshall Law School.

David J. Gerber, Distinguished Professor of Law and Co-Director of the Program in International and Comparative Law. B.A., Trinity College; M.A., Yale University; J.D., University of Chicago.

Douglas Wm. Godfrey, Professor of Legal Research and Writing. B.A., M.A., University of Illinois, Urbana-Champaign; J.D., University of Michigan Law School.

Richard J. Gonzalez, Clinical Professor of Law. B.A., Northwestern University; J.D., Ohio State University College of Law.

Sanford N. Greenberg, Associate Professor of Legal Research and Writing. A.B., Princeton University; J.D., George Washington University; M.A., Ph.D., University of California, Berkeley.

Vivien C. Gross, Clinical Professor of Law. B.A., Northwestern University; M.A., University of Illinois, Urbana-Champaign; J.D., Indiana University Law School.

Philip N. Hablutzel, Professor of Law. B.A., Louisiana State University; M.A., J.D., University of Chicago.

Sarah K. Harding, Associate Professor of Law and Associate Dean. B.A., McGill University (Canada); LL.B., Dalhousie University (Canada); B.C.L., Oxford University (England); LL.M., Yale Law School.

Edward C. Harris, Associate Professor of Law for the International LL.M. Programs. B.A., Loyola University Chicago; J.D., Chicago-Kent College of Law.

Steven L. Harris, Professor of Law. B.A., J.D., University of Chicago.

Steven J. Heyman, Professor of Law. A.B., Harvard College; J.D., Harvard Law School.

Kari L. Johnson, Associate Professor of Legal Research and Writing. B.A., St. Olaf College; J.D., University of Minnesota Law School.

Pamela Kentra, Clinical Professor of Law. B.A., University of Illinois, Urbana-Champaign; J.D., Chicago-Kent College of Law.

Richard S. Kling, Clinical Professor of Law. B.A., University of Illinois, Chicago; J.D., Northwestern University School of Law.

Robert H. Knowles, Visiting Assistant Professor of Law. B.A., St. Olaf College; J.D., Northwestern University School of Law.

Edward Kraus, Associate Clinical Professor of Law. B.A., University of Michigan; J.D., Georgetown University Law Center.

Harold J. Krent, Dean and Professor of Law. A.B., Princeton University; J.D., New York University School of Law.

Gary S. Laser, Associate Professor of Law, Director of Clinical Education and Co-Director of the Program in Criminal Litigation. B.B.A., J.D., University of Miami.

Laurie E. Leader, Clinical Professor of Law. A.B., Washington University; J.D., Cleveland-Marshall College of Law.

Edward Lee, Professor of Law and Director of the Program in Intellectual Property Law. B.A., Williams College; J.D., Harvard Law School.

Martin H. Malin, Professor of Law and Director of the Institute for Law and the Workplace. B.A., Michigan State University; J.D., George Washington University.

Nancy S. Marder, Professor of Law. B.A., Yale University; M.Phil., University of Cambridge; J.D., Yale Law School.

Sheldon H. Nahmod, Distinguished Professor of Law and Co-Director of the Institute for Law and the Humanities. A.B., University of Chicago; LL.B., LL.M., Harvard University.

Terrance A. Norton, Member of the Clinical Faculty and Director of the Center for Open Government. B.A., University of Notre Dame; J.D., DePaul University College of Law.

Henry H. Perritt, Jr., Professor of Law and Director of the Graduate Program in Financial Services Law. S.B., S.M., Massachusetts Institute of Technology; J.D., Georgetown University Law Center.

Mickie A. Piatt, Associate Professor of Law and Executive Director of the Program in Intellectual Property Law. B.A., M.L.S., J.D., University of Texas, Austin.

Natalie Brouwer Potts, Assistant Clinical Professor of Law. B.A., University of Chicago; J.D., Cornell Law School.

César F. Rosado Marzán, Assistant Professor of Law. Ph.D., M.A., Princeton University; J.D., University of Pennsylvania; B.A., Haverford College.

Mark D. Rosen, Professor of Law. B.A., Yale College; J.D., Harvard Law School.

David S. Rudstein, Professor of Law and Co-Director of the Program in Criminal Litigation. B.S., LL.M., University of Illinois, Urbana-Champaign; J.D., Northwestern University.

Christopher W. Schmidt, Assistant Professor of Law. B.A., Dartmouth College; M.A., Ph.D., J.D., Harvard University.

David L. Schwartz, Assistant Professor of Law. B.S., University of Illinois, Urbana-Champaign; J.D., University of Michigan Law School.

Michael A. Scodro, Assistant Professor of Law. A.B., Dartmouth College; J.D., Yale Law School.

Christopher B. Seaman, Visiting Assistant Professor of Law. B.A., Swarthmore College; J.D., University of Pennsylvania Law School.

Carolyn Shapiro, Assistant Professor of Law. B.A., University of Chicago; M.A., University of Chicago Harris Graduate School of Public Policy; J.D., University of Chicago Law School.

Jeffrey G. Sherman, Professor of Law. A.B., J.D., Harvard University.

Stephen D. Sowle, Assistant Dean for Academic Administration and Student Affairs and Senior Lecturer. B.A., Williams College; J.D., Yale Law School.

Michael I. Spak, Professor of Law. B.S., J.D., DePaul University; LL.M., Northwestern University.

Ronald W. Staudt, Professor of Law and Associate Vice President for Law, Business and Technology. B.S., B.A., St. Joseph's College; J.D., University of Chicago.

Joan E. Steinman, Distinguished Professor of Law. A.B., University of Rochester; J.D., Harvard Law School.

Stephanie M. Stern, Associate Professor of Law. B.A., Brown University; J.D., Yale Law School.

Margaret G. Stewart, Professor of Law. B.A., Kalamazoo College; J.D., Northwestern University.

Keith Ann Stiverson, Director of the IIT Downtown Campus Library and Senior Lecturer. M.S.L.S., Catholic University of America; J.D., Georgetown University Law Center.

Kent Streseman, Associate Professor of Appellate Advocacy and Director of the Ilana Diamond Rovner Program in Appellate Advocacy. B.A., University of California, Davis; J.D., Cornell Law School.

Mary Rose Strubbe, Professor of Legal Research and Writing, Director of the Legal Research and Writing Program, and Assistant Director of the Institute for Law and the Workplace. B.A., Mundelein College; J.D., Chicago-Kent College of Law.

A. Dan Tarlock, Distinguished Professor of Law and Director of the Program in Environmental and Energy Law. A.B., LL.B., Stanford University.

Richard Warner, Professor of Law and Faculty Director of the Center for Law and Computers. B.A., Stanford University; Ph.D., University of California, Berkeley; J.D., University of Southern California Law Center.

Richard W. Wright, Distinguished Professor of Law. B.S., California Institute of Technology; J.D., Loyola University of Los Angeles; LL.M., Harvard University.

Admission Requirements

Applicants for admission to Chicago-Kent must have received a bachelor's degree from an accredited college or university prior to beginning classes at the law school. Students are admitted to the law school based on the information contained in their applications, their LSAT scores, undergraduate records, personal statements and their letters of recommendation. All candidates must take the LSAT and register with the LSAC Credential Assembly Service. For additional information on admission requirements, potential students should contact the law school admissions office at 312.906.5020 or visit the Chicago-Kent admissions Web site at www.kentlaw.edu/adm.

Juris Doctor (J.D.)

The college offers both full-time and part-time divisions. Entrance, scholastic and graduate requirements are the same for both divisions, and full-time faculty teach in both divisions. Entering classes begin only in the fall. Three years are normally required for full-time day division students to complete the 87 credit hours needed for the Juris Doctor (J.D.) degree. Evening division and part–time day division students normally take four years, including one summer session, to graduate. A selection of courses is offered each summer, mostly in the evening. First-year courses are required, while most courses in the second and third years are elective, although the faculty recommends that all students take certain upperclass courses. In addition to traditional courses, the curriculum offers a wide variety of innovative courses and seminars to enrich the student's academic experience.

Master of Laws (LL.M.)

Chicago-Kent offers Master of Laws (LL.M.) degree programs in taxation, international and comparative law, international intellectual property law, family law, and financial services law. Each program requires 24 credit hours. The courses are taught by outstanding practitioners and offer students the opportunity to do advanced research and writing under the direct supervision of a faculty member. A student may pursue these programs on a full- or part-time basis. The LL.M. in International and Comparative Law is offered to foreign attorneys. Chicago-Kent also offers combined J.D./LL.M. degree programs in taxation, family law, and financial services law, which enable students to earn both degrees after seven semesters in residence instead of eight.

J.D./LL.M. in Family Law

Chicago-Kent offers a combined J.D./LL.M. program in family law that allows students to gain the broad expertise required of contemporary family law practitioners. The practice-oriented curriculum—the only one of its kind in the United States—encompasses family law and attendant, increasingly complex issues of tax, finance, real estate, business entities, contracts, and child psychology.

J.D./LL.M. in Financial Services Law

Deregulation of financial services, tax reforms, and revolutionary market forces have created an environment in which attorneys and other professionals must broaden their knowledge and sharpen their analytical skills and understanding in these areas. The graduate program in financial services law offers both full- and part-time students a unique opportunity to broaden their understanding of the principles underlying increasingly complex systems and services, deepen their knowledge of particular topics of interest, and enhance their skills as professionals. Courses are offered on weekday evenings and on Saturdays.

J.D./LL.M. in Taxation

The law school offers a combined J.D./LL.M. program in taxation that enables a student to earn both a J.D. and a Master of Laws (LL.M.) in taxation in a total of seven semesters of full-time study instead of eight. A student may take six LL.M. courses (12 credit hours of coursework) while a J.D. candidate. These 12 credit hours will be applied toward both the J.D. and the LL.M. The student will earn the J.D. in the usual time but will then go on, as a graduate student with advanced standing, to earn the LL.M. in only one additional semester instead of two. A degree of Master of Laws in Taxation is a recognized certification of exceptional knowledge and skill in tax law and tax planning.

J.D./M.B.A.

A joint degree J.D./M.B.A. program in conjunction with IIT's Stuart School of Business allows students to receive both J.D. and M.B.A. degrees in a reduced time period, depending on undergraduate preparation. The primary objective of the program is to provide law students with a strong academic background in management. This program is particularly valuable for those law students who intend to be involved in activities and commercial transactions within the business community. The M.B.A. program's focus on professional specialization, combined with business-oriented law courses in the law school curriculum, enhances a lawyer's ability to work effectively as part of the corporate and business world.

J.D./M.S. in Environmental Management and Sustainability

The law school offers a joint J.D./M.S. in Environmental Management and Sustainability degree program in conjunction with IIT's Stuart School of Business. The Environmental Management Program is a unique multidisciplinary program integrating engineering, law, and business management to answer the increasing demand for management-level personnel who have an understanding of environmental issues. An attorney with environmental training is able to work either as a lawyer or in corporate or governmental management.

J.D./M.S. in Finance

The law school, in conjunction with the Stuart School of Business, offers a joint-degree J.D./M.S. in Finance. The program is designed for students who wish to specialize in securities and commodities law for a law firm, brokerage firm, commodity exchange, or trading company. Students gain a unique perspective on the economics of financial products and markets that are used to advise clients, to propose regulation, or to litigate.

J.D./M.P.A.

The law school offers a joint-degree J.D./M.P.A. in conjunction with IIT's Stuart School of Business. This program explores practices and policies in the public sector.

J.D./Master of Public Health (M.P.H.)

The law school offers a joint-degree J.D./M.P.H. in conjunction with the University of Illinois at Chicago. Students in the program must independently matriculate into the UIC School of Public Health. The comprehensive curriculum addresses contemporary issues at the intersection of public health, law, and medicine. Students in the joint-degree program acquire legal tools to help solve pressing public health problems, learn how to impact public policymakers, explore and understand the empirical assumptions about public health that drive legal decision-making, and discover how emerging medical technologies and new healthcare delivery mechanisms are likely to be regulated.

Certificate Programs

Students enrolled in the J.D. program at Chicago-Kent may earn certificates in specialized areas. Certificates indicate that, as part of the required J.D. curriculum, the student has completed an identified subset of elective courses in the area of specialization.

Criminal Litigation

Chicago-Kent's Program in Criminal Litigation is designed to give students a comprehensive and balanced professional education to prepare them for the practice of criminal law. To earn the certificate, students must complete 24 credit hours of coursework from an approved curriculum. With emphases on both theory and practical skills development, the certificate program represents an opportunity to synthesize the goals of Chicago-Kent's academic program in criminal law with those of the Trial Advocacy Program and the Chicago-Kent Law Offices.

Environmental and Energy Law

The Program in Environmental and Energy Law trains students to be environmental and energy professionals as well as law practitioners. Taking an interdisciplinary approach to the field's scientific, economic and ethical aspects, the program immerses students in the statutes and administrative regulations, case decisions, and theoretical underpinnings of environmentalism. The program attracts students from a wide range of professions. A highly regarded faculty teaches a carefully considered curriculum addressing a wide variety of cutting-edge issues.

Students in the program complete 14 credit hours of approved coursework. If students are full-time, these courses are taken during the second and third years; if students are part-time, courses are taken during the second, third and fourth years.

Intellectual Property Law

Intellectual property lawyers work where the law intersects with technology, science and the arts to protect their clients' creative products. The field of intellectual property law focuses on issues relating to patents, copyrights, trade secrets, unfair competition and antitrust. As part of the program's rigorous practical skills training, students learn how to draft intellectual property documents through specialized legal research and writing courses and develop litigation skills by participating in moot court competitions. The program encourages scholarship and discourse among academics, practitioners and students with events like the Chicago Intellectual Property Colloquium. Students complete 20 credit hours of approved coursework, including courses in patent law, copyright law, and trademark and unfair competition law.

International and Comparative Law

In a climate of continuous change, Chicago-Kent's Program in International and Comparative Law addresses the law's global implications and extensive reach. Students can learn how to conduct an international business transaction, develop the skills to navigate between different legal regimes, and learn about the legal structures of international institutions and organizations. The program offers opportunities to link coursework to externships, foreign law study, and projects in nations across the globe. Students in the program must successfully complete 14 credit hours of course study in international and comparative law, including a 2-credit seminar.

Students can take advantage of the Library of International Relations, which contains a diverse collection of international legal, historical, and business-related reference materials and is a depository library for the United Nations and the European Union.

Labor and Employment Law

The Program in Labor and Employment Law is the centerpiece of Chicago-Kent's Institute for Law and the Workplace. Through a logical, carefully paced sequence of coursework and practical skills training, the program provides comprehensive, rigorous preparation for the field of labor and employment law. To earn a certificate, program participants must complete four core courses, a seminar course, a practicum, and additional electives. The core courses are Labor Law, Employment Relationships, Employment Discrimination, and a specialized advanced legal research and writing course in labor and employment law.

Litigation and Alternative Dispute Resolution

Chicago-Kent's Program in Litigation and Alternative Dispute Resolution offers an innovative curriculum that stresses the connection between legal doctrine, skills and values, and the art of lawyering. The program provides comprehensive training in trial skills, negotiation and mediation, and a rigorous curriculum of clinical education. Students in the program complete a series of courses that includes alternative dispute resolution, evidence, pretrial litigation, and trial advocacy. In-house clinical education takes place in the Law Offices of Chicago-Kent, the school's acclaimed teaching law firm, where students work with clinical professors on cases in criminal, civil rights, employment, family, health, immigration, and tax law.

Public Interest Law

The Certificate in Public Interest Law builds on Chicago-Kent's strong public interest tradition and adds a concentrated curriculum to the rich array of activities, courses and resources that encourage Chicago-Kent students to consider public interest law and prepare students to be effective public interest lawyers. The certificate requires 12 credit hours, including Public Interest Law and Policy and a specialized advanced legal research and writing course concentrating on public interest law. Because the substantive scope of public interest lawyering is so broad, each student meets with the director of the program to plan additional courses and at least one public interest clinic or externship to satisfy individual career and interest objectives. Each student also meets several times with the Career Services Office to complete a personalized Public Interest Career Path Plan.

The Public Interest Law Certificate is distinct from, but coordinated with, the current volunteer program of pro bono activities at the law school. The Chicago-Kent Certificate of Service, which can be obtained by volunteering for pro bono service during law school under the Public Interest Resource Center (PIRC), is a requirement for the Certificate in Public Interest Law, but the PIRC certificate remains a distinct credential that any student can obtain.

Trial Advocacy

Chicago-Kent offers a two-semester sequence in trial advocacy taught by judges and practitioners with extensive trial experience. In the first semester, students practice jury selection, opening statements, direct examination, cross-examination and closing arguments, and they conduct at least two full trials. In the second semester, students learn strategic trial techniques and conduct at least four full trials.

An advanced course in litigation technology ensures students are prepared to use computer technology in the courtroom, a critical aspect of contemporary trial practice.

Course Descriptions

See the Chicago-Kent College of Law Web site for detailed information about faculty (www.kentlaw.edu/faculty) and courses (www.kentlaw.edu/academics/courses.html).

Department of Civil, Architectural and Environmental Engineering

228 Alumni Hall
3201 S. Dearborn St.
Chicago, IL 60616
312.567.3540
312.567.3519 fax
cae@iit.edu
www.iit.edu/engineering/cae/

Chair:
Jamshid Mohammadi

The Department of Civil, Architectural and Environmental Engineering offers graduate instruction in structural engineering, transportation engineering, geotechnical engineering, geoenvironmental engineering, environmental engineering, public works, construction engineering and management, and architectural engineering. The department maintains relationships with business, industry and government. An active research program provides highly relevant perspectives on current engineering challenges and issues in the field.

Degrees Offered

Master of Architectural Engineering
Master of Construction Engineering and Management
Master of Environmental Engineering
Master of Geoenvironmental Engineering
Master of Geotechnical Engineering
Master of Public Works
Master of Structural Engineering
Master of Transportation Engineering

Master of Science in Civil Engineering with specialization in:

- Architectural Engineering
- Construction Engineering and Management
- Geotechnical Engineering
- Geoenvironmental Engineering
- Structural Engineering
- Transportation Engineering

Master of Science in Environmental Engineering
Doctor of Philosophy in Civil Engineering
Doctor of Philosophy in Environmental Engineering

Combined-Degree Program

Bachelor of Architecture/Master of Architectural Engineering
Bachelor of Architecture/Master of Construction Engineering and Management
Bachelor of Architecture/Master of Structural Engineering

Certificate Programs

Air Resources
Construction Management
Earthquake and Wind Engineering Design
Geoenvironmental Engineering
Hazardous Waste Management
Indoor Air Quality
Infrastructure Engineering and Management
Transportation Systems Planning
Waste and Wastewater Treatment

Research Facilities

Research facilities include laboratories devoted to concrete structures, structural models, metal structures, materials, architectural engineering, geotechnical engineering, transportation engineering, construction engineering and management, and environmental engineering. In addition, researchers have access to the extensive on-campus facilities of the IIT Research Institute and the Argonne National Laboratory nearby. The department has a computer-aided engineering and design lab equipped with state-of-the-art hardware and software.

Research Areas

The main research areas in the department are structural, architectural, geotechnical and geoenvironmental engineering, construction engineering and management, transportation engineering, environmental engineering, and public works. The faculty conducts research in structural mechanics, analysis methods and design in concrete and steel; bridge engineering; acoustics; airflow and thermal modeling, energy conservation, indoor air quality and thermal comfort; soil mechanics, rock mechanics, engineering geology, earthquake engineering, soil structure and soil-water interactions; construction techniques, site productivity, contracts and specifications, planning, scheduling and control of construction activities, quantity takeoff and estimating, economic decision analysis, construction equipment, systems analysis, contract administration and computer applications in scheduling, estimating, resource planning and cost control; traffic engineering, urban transportation planning, traffic flow theory, public transport, and transportation systems management. In environmental enginering,main research areas are air pollution, energy and sustainability, hazardous waste engineering, indoor air quality and wastewater engineering.

Research in the public works specialty area includes public policy evaluation, management of engineering operations, maintenance, repair and rehabilitation of bridges, and rehabilitation and renovation of existing infrastructures. The department also conducts research in the areas of architectural engineering and building envelopes, acoustics, fire protection and safety engineering, fire prevention and protection during construction, fire load environment and performance-based design.

Faculty

Paul Anderson, Associate Professor of Environmental Engineering. B.S., Purdue University; M.S., University of California, San Diego; Ph.D., University of Washington. Physical-chemical processes in water and wastewater treatment, watershed management, industrial ecology education, biosolids mineralization, and trace element geochemistry.

David Arditi, Professor of Civil and Architectural Engineering. B.S., M.S., Middle East Technical University (Turkey); Ph.D., Loughborough University of Technology (United Kingdom). Construction engineering and management.

Jeffrey S. Budiman, Associate Professor of Civil and Architectural Engineering. B.S., Bandung Institute of Technology (Indonesia); M.S., Illinois Institute of Technology; Ph.D., University of Colorado, Boulder. Geotechnical and geoenvironmental engineering.

Sidney A. Guralnick, Perlstein Distinguished Professor of Engineering, Emeritus, and Director of the Advanced Building Materials and Systems Center. B.S., Drexel Institute of Technology; M.S., Ph.D., Cornell University. Structural engineering and materials of construction.

C. Jotin Khisty, Professor Emeritus of Civil and Architectural Engineering. B.S., Nagpur University (India), M.S., M.C.P., University of Cincinnati; Ph.D., The Ohio State University. Transportation systems, traffic engineering and infrastructure systems.

Zongzhi Li, Associate Professor of Civil and Architectural Engineering. B.E. Changan University, (China); M.S., Ph.D., Purdue University.

Cindy Menches, Assistant Professor of Civil and Architectural Enginering. B.S., University of Southern California; M.S., Pennsylvania State University; Ph.D., Universiy of Wisconsin, Madison. Construction Engineering and Management.

Mehdi Modares, Visiting Assistant Professor. B.S, Azad Unversity (Iran); MS., Cleveland State University; Ph.D., Case Western Reserve University. Computational mechanics, Solid mechanics.

Jamshid Mohammadi, Professor of Civil and Architectural Engineering and Chairman. B.S., M.S., University of Teheran (Iran); M.S., Ph.D., University of Illinois, Urbana-Champaign. Structural reliability and bridge engineering.

Demetrios J. Moschandreas, Professor of Environmental Engineering. B.S., Stetson University; M.S., University of Kentucky; M.S., Ph.D., University of Cincinnati. Air quality transport, exposure analysis, risk assessment, indoor air quality, Environmental Index theory and application, sustainable environmental development.

Ralph T. Muehleisen, Clinical Associate Professor of Civil and Architectural Engineering. B.S., University of Wisconsin, Madison, Ph.D., The Pennsylvania State University. Architectural acoustics, building simulations development including lighting and acoustics.

Kenneth E. Noll, Professor of Environmental Engineering. B.S., Michigan Technical University; M.S., Ph.D., University of Washington. Design of ail pollution control devices, study of atmospheric aerosols, VOC emissions from wastewater treatment plants, and physical and chemical changes and fates of toxic air.

James Novak, Senior Lecturer and Director, Engineering Graphics Division. M.S., Illinois Institute of Technology

John R. O'Leary, Associate Professor of Civil and Architectural Engineering, Emeritus. B.S., M.S., Illinois Institute of Technology; Ph.D., University of Texas, Austin. Solid mechanics and computational methods.

Krishna Pagilla, Professor of Environmental Engineering. B.E., Osmania University (India); M.S., University of Oklahoma, Norman; Ph.D., University of California, Berkeley. Water and wastewater engineering, environmental microbiology, biological nutrient control, soil remediation, and sludge treatment.

Jay H. Shen, Associate Professor of Civil and Architectural Engineering. B.S., Hefei University; M.S., Chinese Academy of Sciences; Ph.D., University of California, Berkeley. Structural engineering and seismic design.

Mark E. Snyder, Senior Lecturer of Civil and Architectural Engineering. B.S., M.S., Creighton University, M.S., Illinois Institute of Technology, Ph.D., Texas Tech University. Building energy and lighting systems, measurement techniques, fire engineering

Admission Requirements

Cumulative undergraduate GPA minimum: 3.0/4.0
GRE minimum score:

For tests taken prior to Oct.1, 2002, M.S./MAS/Ph.D.:
1200 (combined)

For tests taken on or after Oct.1, 2002, M.S./MAS:
900 (quantitative + verbal) 2.5 (analytical writing)

For tests taken on or after Oct.1, 2002, Ph.D.:
1000 (quantitative + verbal) 3.0 (analytical writing)

TOEFL minimum: 550/213/80*

Note: The GRE requirement is waived for Professional Masters degree applicants who hold a Bachelor of Science in a related field, from an ABET-accredited university in the U.S., with a minimum GPA of 3.0/4.0.

Meeting the minimum GPA and test score requirements does not guarantee admission. Test scores and GPA are just two of many factors considered.

Admission to graduate degree programs in civil engineering normally requires a Bachelor of Science degree in civil engineering from an institution accredited by Accreditation Board of Engineering and Technology (ABET). The masters programs in construction engineering and management and in architectural engineering also accept a bachelors degree in architecture. Students who have completed an accredited program in a related field or in a foreign school may be admitted on a provisional status until any deficiencies in preparation are removed.

Admission to graduate degree programs in environmental engineering requires a bachelor degree in an appropriate undergraduate field, awarded by an educational institution of recognized standing. In addition, proof of high-quality academic ability in the applicants undergraduate program must be provided. Prerequisites for the program vary; however, it is expected that all applicants will have had one year each of calculus and chemistry. Qualified applicants with degrees in the life sciences, engineering, and the physical sciences will normally be admitted to the program without extensive prerequisites.

Every full-time civil and architectural engineering graduate student is assigned a faculty adviser by the department chair at the time of initial registration. All part-time or non-degree students who have not been assigned an adviser and who intend to pursue a program toward a degree should contact the department chairman for counseling before registering for courses. Departmental seminars and colloquia are conducted on a regular basis each semester. All full-time civil and architectural engineering graduate students are expected to register for CAE 593 each semester and attend these seminar meetings regularly. All full-time environmental engineering students are required to take the environmental engineering seminar course ENVE 590 every semester.

* Paper-based test score/computer-based test score/interet-based test score.

Master of Architectural Engineering

Master of Construction Engineering and Management

Master of Geoenvironmental Engineering

Master of Geotechnical Engineering

Master of Structural Engineering

Master of Transportation Engineering

32 credit hours (minimum)

These master's programs are course-only, professionally oriented degree programs that permit a concentration in preparation for engineering practice. Admission requirements to the programs in construction, architectural, geoenvironmental, geotechnical, structural and transportation engineering are the same as those for the M.S. program, with one possible exception. The GRE requirement is waived for applicants who hold a Bachelor of Science in a related field from an ABET-accredited university in the United States with a minimum GPA of 3.0/4.0. Candidates in these programs must complete a minimum of 32 credit hours, three of which may be a special project course, CAE 597. Up to 12 credit hours of 400-level undergraduate coursework (except CAE 431 and CAE 432) may be included in the professional master's program with prior adviser approval. No thesis or comprehensive examination is required for successful completion of this degree.

Architectural Engineering

This program is oriented toward students who need to develop more knowledge about buildings. Students are expected to have educational backgrounds in disciplines such as architecture, structural engineering, mechanical engineering, and/or electrical engineering. The program covers the three basic aspects of architectural engineering: mechanical and electrical systems, structures and construction management.

This program involves four core courses, four or five elective courses from one field of concentration, and two courses from any relevant field of concentration, general background courses, or graduate courses offered by the College of Architecture.

Core courses

CAE 471 Construction Planning and Scheduling
CAE 531 Physical Performance of Buildings
CAE 542 Acoustics and Lighting
CAE 574 Economic Decision Analysis in Civil Engineering

Construction Engineering and Management

The professional master's program in construction engineering and management provides students with the knowledge and background that is essential to making decisions at site, company, industrial and sector levels. Students learn how to plan and schedule projects, estimate and control costs, make economic decisions, administer contracts, organize construction sites, manage construction equipment, analyze productivity, optimize construction activities, and address legal problems.

Core courses

CAE 570 Legal Issues in Civil Engineering
CAE 574 Economic Decision Analysis in Civil Engineering
CAE 575 Systems Analysis in Civil Engineering
CAE 577 Construction Equipment Management

Geoenvironmental Engineering and Geotechnical Engineering

The geoenvironmental and geotechnical engineering programs provide background knowledge and training to prepare students to analyze, design and construct structures, and to provide solutions to problems in geotechnical engineering and environmental geotechnics. The subjects include engineering behavior of soil and rock, geomechanics, foundations, earth support structures, dams, tunnels, slope stability, geotechnical earthquake engineering and soil dynamics, site improvement, geosynthetics, groundwater, pollutant transport, chemical behavior of soil, waste disposal facilities. Laboratory experiments and computer analyses/modeling are incorporated.

Geoenvironmental Engineering core courses

CAE 562 Engineering Behavior of Soils
CAE 567 Physicochemical Behavior of Soils
CAE 589 Groundwater Hydrology and Sampling
CAE 590 Geotechnical Landfill Design and Maintenance

Geotechnical Engineering core courses

CAE 562 Engineering Behavior of Soils
CAE 564 Design of Foundations, Embankments and Earth Structures
CAE 565 Rock Mechanics and Tunneling
CAE 566 Earthquake Engineering and Soil Dynamics

Structural Engineering

IIT's professional program in structural engineering provides students with the knowledge needed to design the built environment. Students learn how buildings and bridges may be designed to resist the forces imposed upon them by external loads, gravity, wind and earthquakes. Up-to-date computer-aided design techniques and the latest national building codes dealing with steel, reinforced concrete, pre-stressed concrete and masonry structures are treated.

Core courses

MMAE 501 Engineering Analysis 1A
CAE 503 Advanced Structural Theory and Design
CAE 518 Advanced Reinforced Concrete
CAE 525 Advanced Steel and Composite Structures

Transportation Engineering

With a Master of Transportation Engineering degree, a student will be a qualified transportation planner and traffic engineer. Additionally, the student will be trained to understand and evaluate the socioeconomic impacts of transportation and infrastructure engineering projects.

Core courses (Choose four, with advisor consent)

CAE 523 Statistical Analysis of Engineering Data
CAE 543 Demand Models for Urban Transportation
CAE 544 Urban Transportation Planning
CAE 546 Public Transportation Systems
CAE 548 Transportation Systems Management
CAE 555 Transportation Systems Evaluation
CAE 575 Systems Analysis in Civil Engineering
ENVE 527 Statistical Analysis of Systems

Master of Public Works (Infrastructure Engineering and Management)

32 credit hours

The Master of Public Works (M.P.W.) degree is the most widely recognized educational credential for professionals engaged in public works and infrastructure engineering and management. IIT's M.P.W. program consists of four mandatory and six to seven elective courses, totaling a minimum of 32 credit hours, drawn from the programs in civil and environmental engineering and public administration. This program is offered in cooperation with IIT's Master of Public Administration program. Admission to the M.P.W. program as a regular graduate student requires a bachelor's degree in engineering or science with a GPA of 3.0/4.0 or better.

Master of Environmental Engineering

32 credit hours
Project option

The objective of this degree program is to prepare students for professional practice in their major discipline (environmental engineering) and to provide a foundation in the fundamental knowledge of their major. The requirements are the same as those for the M.S. degree, with the following exceptions:

At least 18 credit hours must be taken in 500-level courses in the student'schosen program (environmental engineering, food process engineering), and the thesis work should be replaced by six to eight hours of coursework or a project.

The student may choose courses in any of the areas of specialization listed for the M.S. programs. Undergraduate courses may sometimes be used to fulfill graduate program requirements in order to overcome defi- ciencies or to broaden the candidate's background. The limit is 12 credit hours in courses numbered 400-499.

Master of Science in Civil Engineering

32 credit hours
Thesis and oral defense

Five technical areas (construction, architectural, geoenvironmental, geotechnical, structural and transportation engineering) are included in the M.S. program. Degree candidates in the Master of Science program must complete a minimum of 32 credit hours, six to eight of which are for research and thesis. Up to 12 credit hours of 400-level undergraduate coursework (except CAE 431 (Steel and Timber Design) and CAE 432 (Concrete and Foundation Design)) may be included in the M.S. program with prior adviser approval. An oral defense of the thesis constitutes the comprehensive examination, and no additional written comprehensive examination is required.

Master of Science in Environmental Engineering

32 credit hours
Thesis

The objective of this program is to enable the student to build a strong foundation in multiple areas of environmental engineering and to specialize in one area via research and thesis. Candidates are required to take a total of 32 credit hours, 15 credits of which must be for the environmental engineering core courses listed below, and six to eight credit hours must be in research and thesis work.

Core courses

ENVE 426* Statistical Tools for Engineers
or CAE 503
ENVE 501 Environmental Chemistry
ENVE 506 Chemodynamics
ENVE 542 Physicochemical Processes in Environmental Engineering
ENVE 580 Hazardous Waste Engineering

*Students with a background in statistics (before joining the graduate program) equivalent to ENVE 426 will be required to take ENVE 527 as a core course (in place of ENVE 426). Students should consult the course descriptions in the Chemical and Biological Engineering section of this bulletin for details.

The student must have a minimum grade point average of 3.0/4.0 in the core areas. Aside from the core courses, coursework may be selected (with adviser approval) to satisfy the needs of the individual student or may be concentrated in one of the areas of specialization available in the department, including:

Air Pollution Engineering
Energy/Environment/Economics (E3)
Environmental Chemistry
Environmental Resource Management
Hazardous Waste Engineering
Water and Wastewater Engineering

Undergraduate courses may sometimes be used to fulfill graduate program requirements. The limit is six credit hours in courses numbered 400-499. Athesis may be completed outside the department only by special arrangement with the department chair. The successful M.S. degree candidate will complete a thesis based on research as well as an oral defense of the thesis, under the direction of the thesis examining committee.

Doctor of Philosophy in Civil Engineering

96 credit hours, including master's degree
(A maximum of 48 credit hours may be transferred from another institution. Students should consult the rules for transfer credit within this bulletin)
Qualifying exam
Comprehensive exam
Dissertation
Oral defense

The full-time doctoral program generally consists of two complete years of academic preparation, followed by one year of full-time research in residence at IIT. To be admitted to candidacy, students must successfully complete a qualifying examination; the department may waive this requirement for students who hold an M.S. degree from IIT in the same field. This examination should be completed within a year of entry into the program. After a student is admitted to candidacy, the department appoints a permanent committee consisting of at least two faculty members of the department and representatives of faculty in the minor fields. The advisory committee may permit the student to initiate research at any time after admission to candidacy when, in the committee's opinion, he or she has achieved adequate preparation. Academic preparation normally includes the equivalent of one year of coursework, with civil engineering as the major field, as well as preparation in such minor fields as applied mathematics or solid mechanics.

The student should discuss the choice of a research adviser with the advisory committee before making his or her selection. The research advisor, if not already a member of the committee, will be added at this time. The research project must be in harmony with the interests of the faculty and with the facilities of the department. Off-campus research for the dissertation is possible if and only if approved by the entire faculty advisory committee. In those cases, the student must register for CAE 691 during each semester in which the thesis is being prepared. The comprehensive examination must be completed at least one year prior to the date of graduation.

Doctor of Philosophy in Environmental Engineering

84 credit hours
Qualifying exam
Comprehensive exam
Thesis proposal
Dissertation and oral defense

The doctorate degree in environmental engineering is awarded in recognition of mastery in environmental engineering and upon demonstration of an ability to make substantial creative contributions to knowledge in environmental engineering. The recipients of these degrees will be capable of a continuing effort toward advancement of knowledge and achievement in research while pursuing anacademic or industrial research career. The program should satisfy the following requirements: environmental engineering study, 30-40 percent; research, 40-50 percent; other fields of study, 10-30 percent. The coursework must include up to 18 credits of core chemical or environmental engineering courses.

In addition to the core courses listed in Master of Science in Environmental Engineering, students must take: ENVE 527 Statistical Analysis of Systems.

Students should consult the Transfer Credits section for rules on how many credit hours may be transferred from another institution.

Students must pass a written qualifying examination within three semesters after they have been admitted to the Ph.D. program. The exam is diagnostic in nature, and the results of the exam will determine the student's potential for success in the Ph.D. program and recommendations for a future program of study. The examination will cover core areas, including environmental chemistry, chemodynamics, environmental systems and analysis, and physicochemical processes.

The comprehensive examination is oral and may include a written exam based on the student's performance on the qualifying exam. The exam questions will be formulated by the members of the Ph.D. examining committee. The examination will also include oral presentation and discussion by the student of a journal article in the student's major (environmental engineering) selected a priori by the examining committee. The exam must be conducted within a year following completion of the qualifying exam. The Ph.D. examining committee, which may be the same as the Ph.D. thesis committee, should be suggested by the advisor and approved and appointed by the chairperson at least three weeks prior to the examination.

The thesis proposal approval examination, which is diagnostic in nature, should be conducted after the comprehensive exam and at least one year before the final thesis defense. The exam will be oral and will be administered by the Ph.D. thesis committee.

Doctoral research can begin after admission to the Ph.D. program. However, the major portion of the research should not be started until the comprehensive examination is passed and the thesis proposal is approved by the committee. All research must be conducted under the supervision of a full-time department faculty member and in the laboratories of the university. Off-campus research is possible with the approval of the department chairperson. The preliminary thesis draft must meet the approval of all members of the examination committee. An oral examination in defense of the thesis is given as an open university seminar. The thesis defense must meet with the approval of the examination committee; if it does not, the committee has the authority to determine whether or not to grant a re-examination.

Bachelor of Architecture/Master of Architectural Engineering

Bachelor of Architecture/Master of Construction Engineering and Management

Bachelor of Architecture/Master of Structural Engineering

Qualified students regularly enrolled at IIT may earn both the Bachelor of Architecture and a professional master's degree. They must complete preparatory courses for, and apply for admission to, the professional master's program prior to entry into the combined program.

Students who anticipate entry into the Master of Architectural Engineering must successfully complete the following courses as part of the technical electives in their undergraduate program in architecture: MATH 151, MATH 152, MATH 251, MATH 252, PHYS 121, PHYS 221, CAE 208, CAE 209, and CAE 383.

Students who anticipate entry into the Master of Construction Engineering and Management are not required to complete any additional courses as part of the technical electives in their undergraduate program in architecture.

Students who anticipate entry into the Master of Structural Engineering must successfully complete the following courses as part of their undergraduate program in architecture: MATH 151, MATH 152, MATH 251, CAE 303, CAE 304, CAE 307, CAE 310, CAE 315, CAE 431 and CAE 432 (in place of MATH 119), MATH 122, CAE 287, CAE 351, and CAE 352.

For undergraduate course descriptions, students should refer to the undergraduate bulletin or the online course description database at www.iit.edu/registrar/academics/.

Certificate Programs in Civil Engineering

Construction Management

Required courses (select four)

CAE 470 Construction Methods and Cost Estimating
CAE 471 Construction Planning and Scheduling
CAE 472 Construction Site Operation
CAE 473 Construction Project Administration
CAE 570 Legal Issues in Civil Engineering
CAE 571 Advanced Construction Scheduling and Control
CAE 572 Construction Cost Accounting and Control
CAE 573 Computer Applications in Construction
CAE 574 Economic Decision Analysis in Civil Engineering
CAE 575 Systems Analysis in Civil Engineering
CAE 577 Construction Equipment Management
CAE 578 Construction Claims Management

Earthquake and Wind Engineering Design

Required courses (select four)

CAE 410 Introduction to Wind and Earthquake Engineering
CAE 420 Introduction to Dynamics of Structures
CAE 431 Steel and Timber Design
CAE 432 Concrete and Foundation Design
CAE 504 Seismic Retrofit and Earthquake Hazard Reduction
CAE 518 Advanced Reinforced Concrete
CAE 525 Advanced Steel and Composite Structures
CAE 582 Structural Wind and Earthquake Engineering

Geoenvironmental Engineering

Required courses

CAE 567 Physicochemical Behavior of Soils
CAE 589 Ground Water Hydrology and Sampling
CAE 590 Geotechnical Landfill Design and Maintenance

AND one of the following:

ENVE 480 Solid Waste Engineering
ENVE 580 Hazardous Waste Engineering
ENVE 585 Groundwater Contamination and Pollutant Transport

Infrastructure Engineering and Management

Required courses

PA 501 Introduction to Public Administration
PA 551 Public Works Management

AND two of the following:

CAE 408 Bridge and Structural Design
CAE 508 Bridge Inspection, Rehabilitation, Repair and Management
CAE 419 Transportation Engineering and Design
CAE 541 Pavement Evaluation and Management
CAE 486 Soil and Site Improvement
CAE 590 Geotechnical Landfill Design and Maintenance
CAE 471 Construction Planning and Scheduling
CAE 574 Economic Decision Analysis in Civil Engineering
ENVE 405 Environmental Impact Assessment
ENVE 551 Design of Sanitary Engineering Process

Transportation Systems Planning

Required courses (select four)

CAE 419 Highway and Engineering Design
CAE 430 Probability Concepts in Civil Engineering Design
CAE 543 Demand Models for Urban Transportation
CAE 544 Urban Transportation Planning
CAE 549 Transportation Economics, Development and Policy
CAE 575 Systems Analysis in Civil Engineering

Certificate Programs in Architectural Engineering

Architectural Engineering

Required courses (select four)

CAE 531 Physical Performance of Buildings

AND three of the following:

CAE 461 Plumbing and Fire Protection Design
CAE 464 HVAC Design
CAE 507 Control of Sound and Vibrations in Buildings
CAE 509 Analysis and Design of Acoustic Spaces
CAE 521 Building Illumination Design
CAE 524 Design of Building Enclosures
CAE 526 Energy Conservation Design in Buildings
CAE 528 Communication and Electrical Systems in Buildings
CAE 542 Acoustics and Lighting
CAE 597 Special Topics in Architectural Engineering

Certificate Programs in Environmental Engineering

Air Resources

This program explores outdoor air quality, causes of outdoor air pollution, and investigative and diagnostic techniques used in outdoor air quality control.

Required courses

ENVE 570 Air Pollution Meteorology

AND two of the following:

ENVE 502 Atmospheric Chemistry
ENVE 572 Ambient Air Monitoring
ENVE 575 Control of Toxic Air Pollution
ENVE 577 Design of Air Pollution Control Devices
ENVE 578 Physical and Chemical Processes for Industrial Gas Cleaning

Hazardous Waste Engineering

This program is an introduction to the characterization of hazardous waste sites, common and innovative remediation techniques, and current issues in hazardous waste engineering.

Required courses

ENVE 580 Hazardous Waste Engineering

AND two courses from the following group:

ENVE 506 Chemodynamics
ENVE 542 Physicochemical Processes in Environmental Engineering
ENVE 577 Design of Air Pollution Control Devices
ENVE 585 Groundwater Contamination

Indoor Air Quality

This program covers sick building syndrome, the causes of indoor air pollution, and investigative and diagnostic techniques used in controlling indoor air quality.

Required courses

ENVE 546 Industrial Hygiene
ENVE 576 Indoor Air Pollution

AND one of the following courses:

ENVE 426 Statistical Tools for Engineers
OR
ENVE 527 Statistical Analysis of Systems
ENVE 575 Control of Toxic Air Pollution
MMAE 452 Air Conditioning and Refrigeration
BIOL 514 Toxicology

Waste and Wastewater Treatment

This program is an introduction to the biological and physical/chemical processes used in water and wastewater treatment, and the design of water and wastewater treatment processes.

Requires courses

ENVE 513 Biotechnological Processes in Environmental Engineering
ENVE 542 Physicochemical Processes in Environmental Engineering

AND of the following courses:

ENVE 551 Industrial Waste Treatment
ENVE 555 Industrial Waste Treatment Design Criteria
ENVE 561 Design of Sanitary Engineering Processes

Course Descriptions

Numbers in parentheses indicate class, lab and credit hours, respectively.

CAE 503
Advanced Structural Theory and Design
Introduction to the mechanics of solids. Energy methods and the calculus of variations. Ritz/Galerkin approximation methods. Introductory discussions on elastic stability and plate analyses. Prerequisite: CAE 310. Corequisite: MMAE 504.
(4-0-4)

CAE 504
Seismic Retrofit and Earthquake Hazard Reduction
Selection of site-dependent earthquake for retrofit. Strength and ductility of aging structures. Cyclic behavior and modeling of structures under seismic loading. Performance-based retrofit criteria. Evaluating earthquake vulnerability of existing buildings and bridges. Upgrading lateral load-carrying systems. Conceptual basis for seismic isolation and energy-absorbing techniques and their applications in earthquake hazard reduction in existing bridges and buildings. Selection of retrofit methods. Case studies of seismic retrofit of typical buildings, bridges and industrial facilities using strength upgrading, energy dissipation devices and base isolation. Prerequisite: CAE 420, CAE 582 or instructor's consent.
(4-0-4)

CAE 505
Infrastructure Rehabilitation Engineering
Repair and rehabilitation of existing deteriorated infrastructure building structures and facilities. Course will include identification of problems, investigative techniques, non-destructive testing methods, discussion of repair materials, and strengthening and preparation of rehabilitation documents.
(2-0-2)

CAE 506
Building Envelope Rehabilitation Engineering
Repair and rehabilitation of existing building exterior envelopes. The course will include problem identification, investigative techniques, repair methods, preparation of remedial design documents, and general management of rehabilitation projects. Types of constructions include buildings, exterior walls, facades, cladding, roofing, plazas and others.
(2-0-2)

CAE 507
Control of Sound and Vibration in Buildings
Basic sound physics and sound propagation in enclosed spaces. Sound and vibration sources in and out of buildings. Theories of sound transmission through building elements. Effects of noise and vibration on man and buildings, criteria and standards. Design of noise control systems. Calculation of airborne and impact sound insulation. Noise and vibration control implementations in various indoor spaces, such as residential units, offices, schools and mechanical rooms. Prerequisite: CAE 542 or instructor's consent.
(3-0-3)

CAE 508
Bridge Inspection, Rehabilitation, Repair and Management
Elements of bridge management, rating and inspection process. Lifecycle, project-level and network-level analyses, condition assessment, case studies, and repair, retrofit and replacement alternatives, and their relation to infrastructure management.
(3-0-3)

CAE 509
Analysis and Design of Acoustic Spaces
This course will discuss the design of acoustic spaces such as conference rooms, classrooms, lecture halls, music halls, theater, churches, recording studio, and home theater. Course covers the selection and determination of appropriate steady state, spatial, and temporal acoustic measures such as background noise levels, reverberation time, speech transmission index, and interaural cross correlation, as well as the selection of building materials and layout of rooms to meet those requirements. Prerequisite: CAE 542 or instructor consent.
(3-0-3)

CAE 510
Dynamics of Fire
Introduction to fire, physics and chemistry, and mass and heat transfer principles, fire fluid mechanic fundamentals, fundamentals and requirements of the burning of materials (gases, liquids, and solids), fire phenomena in enclosures such as pre-flashover and post-flashover. Prerequisites: MMAE 310 or MMAE 313 or CAE 302, MMAE 322 or CAE 309 or instructor's consent. (Students who have taken the undergraduate course equivalent, CAE 424, may not take this course for credit).
(3-0-3)

CAE 511
Fire Protection of Buildings
Fundamentals of building design for fire and life safety. Emphasis on a systematic design approach. Basic considerations of building codes, fire loading, fire resistance, exit design, protective systems, and other fire protection systems. For architects and engineers not majoring in fire protection and safety engineering. (Students who have taken the undergraduate course equivalent, CAE 425, may not take this course for credit).
(3-0-3)

CAE 512
Computer Modeling of Fire
Introduction to fire heat transfer processes and fire testing materials; application of a set of quantitative engineering tools (fire models) to construct a description of conditions that occur or might occur during the course of a fire; life and structural impacts from hostile fires in buildings. Prerequisites: CAE 424 or instructor's consent. (Students who have taken the undergraduate course equivalent, CAE 426, may not take this course for credit).
(3-0-3)

CAE 514
Mathematical Methods for Structural Engineering
Matrices, linear spaces and transformations, eigen value problems. First-order differential equations for structural dynamics. Calculus of variations and variational principles for dynamics and statics. Rayleigh- Ritz method, finite element approximations, Newmark-Beta method, Green's Function, and Duhamel Integral.
(3-0-3)

CAE 518
Advanced Reinforced Concrete
Mechanical properties of hardened concrete, including creep phenomena. Ultimate strength of columns, beams and beam-columns. Introduction to limit analysis of frames and yieldline analysis of plates. Prerequisite: CAE 432.
(3-0-3)

CAE 520
Buckling of Structures
Review of simple column buckling for various conditions. Basic considerations of stable and unstable equilibrium. Determination of buckling loads of columns with variable cross-section. Analysis of elastic stability of framed structures. Approximate solutions of more complicated problems by various numerical and energy methods. Analysis of lateral and torsional stability of beams and beamcolumns. Stability in the inelastic range of columns. Buckling of plates and cylindrical shells. Prerequisites: CAE 310, CAE 431. Corequisite: MMAE 504.
(4-0-4)

CAE 521
Building Illumination Design
An intensive study of the calculation techniques and qualitative aspects of good luminous design. Topics covered include photometric quantities and color theory, visual perception, standards, daylight and artificial illumination systems, radiative transfer, fixture and lamp characteristics, control devices and energy conservation techniques. Design problems, field measurements, computer and other models will be used to explore the major topics. Prerequisite: instructor's consent. (Students who have taken the undergraduate course equivalent, CAE 467, may not take this course for credit).
(3-0-3)

CAE 522
Structural Model Analysis
Theory of measurements, statistics, similitude and model laws and the usefulness of structural models. Displacement and strain measurement techniques. Theory and practice of indirect model analysis. Theory and practice of direct model techniques, including photoelasticity and moire methods. Prerequisite: CAE 503.
(4-0-4)

CAE 523
Statistical Analysis of Engineering Data
Review of probability, random variables, distribution models, estimation of statistical parameters and testing validity of distribution models. Analysis of variance (ANOVA), hypothesis testing, correlation analysis, multiple range tests, pairwise comparisons, data compilation using unconventional sources, such as using simulations, expert opinion and cycle-counting methods. Prerequisite: MATH 252 or equivalent.
(3-0-3)

CAE 524
Building Enclosure Design
Study of wall, window, and roof design. Consideration for the factors that influence the design of building exteriors including the control of heat flow, air and moisture penetration, building movements and deterioration. Study of the principle of rain screen walls and energy conserving design. Analytical techniques and building codes are discussed. Prerequisite: CAE 531.
(3-0-3)

CAE 525
Advanced Steel and Composite Structures
Torsion and web openings. Behavior and design of rigid and semirigid beam-to-column connections and base plates. Inelastic behavior of steel and composite members and systems under severe cyclic loading. Design of steel-concrete composite and hybrid systems. P-delta effect and design consideration for system stability. Design of special and ordinary moment-resisting frames. Design of concentrically and eccentrically braced frames. Design of bracing for stability. Plate girders. Fatigue and fracture. Prerequisites: CAE 431 or equivalent.
(4-0-4)

CAE 526
Energy Conservation Design in Buildings
Identification of the optimal energy performance achievable with various types of buildings and service systems. Reduction of infiltration. Control systems and strategies to achieve optimal energy performance. Effective utilization of daylight, heat pumps, passive and active solar heaters, heat storage and heat pipes in new and old buildings. Prerequisite: instructor's consent. (Students who have taken the undergraduate course equivalent, CAE 465, may not take this course for credit).
(3-0-3)

CAE 527
Control of Building Environmental Systems
Introduction to automatic control systems. Control issues related to energy conservation, indoor air quality and thermal comfort in buildings. Classification of HVAC control systems. Control system hardware: selection and sizing of sensors, actuators and controllers. Practical HVAC control systems; elementary local loop and complete control systems. Designing and tuning of controllers. Building automation systems. Case studies. Computer Applications. Prerequisite: instructor's consent or CAE 528 or CAE 466 or concurrent registration. (Students who have taken an equivalent undergraduate course may not take this course for credit).
(3-0-3)

CAE 528
Communication and Electrical Systems in Buildings
Study of the analysis and design of electrical systems in buildings utilizing the National Electrical Code. The topics include basic circuits, ac and dc, single phase and three-phase power, transients, capacitance and inductance, branch circuits, panel boards, motors, system sizing, and electrical distribution in buildings. Study of the design and specification of communication systems in buildings, including fire alarm, security, sound, and telephone. Prerequisite: instructor's consent. (Students who have taken the undergraduate course equivalent, CAE 466, may not take this course for credit).
(3-0-3)

CAE 529
Information Technology in Buildings
Understanding the potential, the advantages, and the difficulties associated with using information technology to gain a strategic advantage in the building industry. Knowing the various components of any information system. Selection of suitable hardware and software for a certain design of construction task. Development and implementation of buildings-oriented databases. Use of the Internet to develop Web pages for project information.
(3-0-3)

CAE 530
Finite Element Method of Analysis
Continuation of CAE 442. Covers advanced and special topics in finite element analysis such as finite element-boundary element method, plates, and shell analysis using finite elements and stochastic finite elements. Prerequisite: CAE 442.
(3-0-3)

CAE 531
Physical Performance of Buildings
Study of the environmental exterior and interior influences (rain, snow, humidity, temperature, wind, sun, etc). on the physical performance of buildings and the implications of these influences on building design. Study of indoor thermal environment and thermal comfort of building occupant is offered as well. (Students who have completed the undergraduate equivalent may not take this course for credit).
(3-0-3)

CAE 532
Analysis of Plates and Shells
Exact and approximate stress analysis of elastic, isotropic plates of various shapes acted upon by forces in their plane, as well as transverse forces. Stability of plates with various edge conditions, orthotropic plates, elastically supported plates and simple cylinders. Approximate methods such as finite differences, finite elements and the methods of Ritz and Galerkin. Corequisite: MMAE 504.
(4-0-4)

CAE 533
Theory and Analysis of Thin Shells
Differential geometry of surfaces. Elastic theory of general shells with nonorthogonal curvilinear coordinates. Specialization to cylindrical shells, shells of revolution and translational shells. Exact and approximate solutions applied to the bending membrane theories of thin shells. Approximate methods including finite differences, finite elements and methods associated with Ritz, Galerkin, Puchler and Gaeckler. Corequisite: MMAE 504.
(3-0-3)

CAE 534
Computational Techniques in Finite Element Analysis
Survey of numerical methods as applied to FEM software. Database management, equation solvers, eigenvalue routines and schemes for direct integration (both implicit and explicit), all as employed in the development of a finite element program. Topics covered also include band and front minimizers, static and dynamic substructuring via superelements and sensitivity studies. Same as MMAE 538. Prerequisite: CAE 442 or MMAE 451.
(3-0-3)

CAE 535
Nonlinear Finite Element Analysis
FEM as applied to nonlinear problems. Contact problems, the mechanics of large deformation, full and updated Lagrange formulations, review of plasticity, solution algorithms, Eulerian approaches, application to FEM to limit analysis. Same as MMAE 539. Prerequisite: CAE 442 or MMAE 507. Corequisite: MMAE 504.
(3-0-3)

CAE 537
Homeland Security Concerns in Building Design
Review of blast effects produced by solid phase weapons and their effects on structures and people. Estimation of the risk of a terrorist attack and the corresponding threat. Review of simplified methods for the analysis and design of structures to meet homeland security concers and procedures to minimize casualties. Analysis of post event fires and how to prevent them. Review of security measure to minimize the effects of blast on buildings and people.
(3-0-3)

CAE 539
Introduction to Geographic Information Systems
Geographic information system (GIS) technology allows databases that display and query information in new ways. This course will teach general GIS and GPS skills and concepts, useful to students and practitioners in a variety of disciplines. Students will complete a final GIS project relevant to their field of study. This hands-on class will use ESRI's ArcView and Spatial Analyst products, as well as Trimble GeoExplorer GPS units.
(3-0-3)

CAE 540
Asphalt Concrete Mix Design
Types of asphalt and physical properties of asphalt. Types of mixes: dense graded, open graded, base courses and maintenance mixes. Types of pavement structures and hot mix asphalt placement. Aggregate physical properties, tests and blending. Maintenance and rehabilitation materials. Mixture design procedures, including Marshall and Hveem procedures and weight-volume relationships. Evaluation of mixture properties, engineering property's importance to performance, resilient modulus, fatigue and creep testing and thermal cracking properties. Laboratory included.
(2-3-3)

CAE 541
Pavement Evaluation and Management
Pavement management systems (PMS) concepts, network definition, condition survey, pavement condition index (PCI), non-destructive deflection testing (NDT), measurement of roughness and skid resistance, micropaver PMS, PMS implementation, project and network-level management, maintenance alternatives, development of annual and long-range work plans. Prerequisite: instructor's consent.
(3-0-3)

CAE 542
Acoustics and Lighting
General introduction to the aural and visual environment. Subjective and objective scales of measurement. Laws of psychophysics. Introduction to vibration. The hearing mechanism. Transfer of sound. Passive control of noise in buildings, transmission loss. Absorption and reverberation time. Active control of the aural environment. Visual perception. Photometry, brightness, luminance and illumination. Natural lighting of buildings. Artificial lighting. Prerequisite: PHYS 221. (Students who have taken the undergraduate course equivalent, CAE 334, may not take this course for credit).
(3-0-3)

CAE 543
Demand Models for Urban Transportation
Fundamental theory of supply and demand, transportation economics, network equilibrium, land use and transportation equilibrium. Demand models: trip generation, geographical distribution, mode split, route assignment, the direct-demand model and disaggregate-behavioraldemand models. Special properties of models. Relationships among models. Prerequisite: CAE 416 or instructor's consent.
(3-0-3)

CAE 544
Urban Transportation Planning
Exploration of the goals of urban transportation. Program planning in relating transportation technology to social, economic and environmental systems. Systems analysis in forecasting travel demand and evaluating alternatives in transportation planning.
(4-0-4)

CAE 545
Traffic Operations and Flow Theory
Studies of space and time distribution of speed and other traffic characteristics in the transportation network. Macro- and microtraffic flow theories. Simulation in traffic systems. Application of flow theories to traffic control and operations.
(3-0-3)

CAE 546
Public Transportation Systems
Operational and economic characteristics of urban systems. Transit planning process: demand for transit, transit routing, transit scheduling, network design. Improvements of existing systems and exploration of new technologies.
(3-0-3)

CAE 547
Advanced Traffic Engineering
Data collection, statistical analysis and interpretation of traffic information. Advanced traffic engineering topics, such as signaling, street-andhighway capacity analysis; accident and safety research. Prerequisite: CAE 419 or instructor's consent.
(3-0-3)

CAE 548
Transportation Systems Management
Transportation as a system. Problems of traffic congestion, land use/transportation intersection; intersection control; freeway and arterial incident management; safety considerations; evaluation of strategies; case studies. Prerequisite: CAE 419 or instructor's consent.
(3-0-3)

CAE 549
Transportation Economics, Development and Policy
Application of managerial, microand macroeconomic concepts to transportation systems. Investment and impact analysis. Transport policy as it relates to social, economic and environmental issues. Legislative actions affecting transport issues. Prerequisite: CAE 419 or instructor's consent.
(3-0-3)

CAE 551
Prestressed Concrete
Theory and design of prestressed concrete members and structure. Applications to both simple and continuous girders and frames subjected to stationary or moving loads. Prestressed cylindrical shells. Prerequisite: CAE 432.
(3-0-3)

CAE 552
Heating and Refrigeration
Heating load analysis, including building shapes, construction type, infiltration, occupancy effects, and daily load variations. Computer applications for thermal load analysis. Water Heating Systems, Steam Heating Systems, Electrical Heating, Central Heating, Heating of Low and High-rise Buildings, Selection of Heaters, Boilers, Pumps, Piping Design. Computer Applications. Reciprocating Refrigeration. Refrigerant, Refrigeration Cycle, Evaporator, Compressor, Condenser, Thermostatic expansion valves, refrigeration system control equipment, motor and motor control equipment, refrigeration accessories, calculation of refrigeration piping and absorption systems. Computer Applications. Prerequisite: Thermodynamics, Heat Transfer, Fluid Mechanics or instructor's consent.
(4-0-4)

CAE 553
Measurement and Instrumentation in Architectural Engineering
Experimental Statistics and Data Analysis. Dynamic measurement. Measurement of Thermal Characteristics (Conductivity, diffusivity, etc). Fluid-Property Measurement (Pressure, Temperature, etc). Fluid Flow measurement (Flow, Viscosity, etc). Blower door and Tracer Gas Techniques. Duct leakage Measurement. Prerequisite: Thermodynamics, Fluid Mechanics and Heat Transfer or instructor's consent.
(3-0-3)

CAE 554
Capstone Architectural Engineering Design Project
The student has to perform major design project or an independent research project under the guidance of a CAE faculty member in one or more from the following areas: HVAC systems, Energy Conservation Technology, Lighting and Illumination, Acoustics, Safety and Fire Protection, Plumbing, Structure, Construction Management or integrated building Design. Requires the approval of the advisor.
(Credit Variable; maximum three hours)

CAE 555
Transportation Systems Evaluation
Concepts and principles of transportation economic analysis, transportation costs and benefits, user and nonuser consequences, needs studies, finance and taxation, methods of evaluation of plans and projects, cost effectiveness, environmental impact assessment. Prerequisites: CAE 419 or instructor's consent.
(3-0-3)

CAE 556
Architectural Engineering Systems
Introduction to systematic solutions of building engineering problems. Techniques to be treated include linear programming, network analysis, nonlinear programming. Introduction to decision analysis and simulation. Application of optimization methods for solution of design problems in building science, building environment, building structures and construction management. Computer Applications.
(3-0-3)

CAE 557
Computer-Aided Building Design
This course introduces students to the process of integrated building design. It emphasizes both computer assistance (CA) and building design (BD). Building design is viewed in a holistic manner integrating related fields such as spatial layouts, structures, enclosures, energy consumption, and construction cost estimation. Building engineering design process: methodology, identification of objectives, building codes, formulation of design problems. Development and evaluation of design alternatives. Conceptual building design: spatial requirements, design of space layout. Preliminary building design: synthesis and design of structures, enclosure systems, and services (HVAC, lighting, electrical distribution) using computer-aided design tools. Performance evaluation using modeling, sensitivity analysis and cost estimation. A major design project is an integral part of this course. Prerequisite: instructor's consent.
(3-0-3)

CAE 560
Plastic Methods
Fundamental concepts of plasticity in the design of steel structures. Principle of plastic hinges. Upperand lower-bound theorems. Alternating plasticity and incremental collapse. Analysis and design of single story and multistory framed structures. Prerequisites: CAE 503, CAE 431.
(4-0-4)

CAE 561
Structural Reliability and Probabilistic Bases of Design
Fundamentals of probability theory and stochastic processes; statistical analysis of engineering data; probabilistic modeling of structural loads and material properties. Reliability analysis and design of structure, reliability-based design criteria. Evaluation of existing design codes. Safety analysis of structures under fatigue loads. Fault and event tree analysis. Prerequisite: CAE 307 or instructor's consent.
(3-0-3)

CAE 562
Engineering Behavior of Soils
Soil mineralogy and soil fabric, soilwater electrolyte system, dispersive clay, stress and strain analyses, elastic equilibrium in soil masses, plastic equilibrium in soil of masses, in situ and laboratory stress paths, shear strength of sands and clays, thermal properties of soils, critical state soil mechanics principles, nonlinear pseudoelastic and elastoplastic constitutive models. Corequisite: CAE 563. Prerequisite: CAE 323.
(4-0-4)

CAE 563
Advanced Soil Mechanics Laboratory
Advanced aspects of soil property measurement with application to design and analysis, system characteristics on soil sediment, pinhole test for identifying dispersive clays, consolidation, triaxial compression and triaxial extension with porewater measurement, cyclic triaxial test, permeability with back pressure, determination of critical void ratio. Corequisite: CAE 562. Prerequisite: CAE 323.
(1-3-1)

CAE 564
Design of Foundations, Embankments and Earth Structures
Consolidation phenomena, derivation of bearing capacity equations, beams and slabs on soils, piles and pile groups, compaction, earth pressure theories and pressure in embankment, slope stability analyses, retaining structures, embankment design, soil structure interaction during excavation, design of anchors for landslide stabilization and retaining structures and instrumentation. Prerequisites: CAE 323, CAE 457.
(4-0-4)

CAE 565
Rock Mechanics and Tunneling
Rock classification for engineering purposes, mechanical behavior of rocks, in situ stresses in rock, stresses around underground openings, rock slope engineering, design of underground structures, design of deep support excavation and tunnels, primary and secondary linings of tunnels, mined shafts, instrumentation. Prerequisite: CAE 457.
(4-0-4)

CAE 566
Earthquake Engineering and Soil Dynamics
Earthquakes and their intensity, influence of ground motion, review of 1-DOF and M-DOF systems, wave propagation theories, vibration due to blast and shock waves, design earthquake motion, dynamic properties of soils, soil liquefaction, bearing capacity during earthquakes and design of machine foundations, isolation of foundations, pile foundation, and dynamic analysis, earth pressure during earthquakes on retaining structures and embankment. Prerequisites: CAE 323, CAE 420.
(4-0-4)

CAE 567
Physicochemical Behavior of Soils
The nature of soils. Weathering and soil formation processes. Soil mineralogy. Surface and colloidal chemistry. Structures of water near clay mineral surfaces. Electrolyte solutions. Theories of cation and anion exchange. Adsorption of inorganic chemicals in soils. Organic matter in soils. Adsorption of organic chemicals in soils. Methods to determine petroleum products in soils. Effect of contaminants on permeability of clays. Leachate-clay liner compatibility. Prerequisites: CAE 323, ENVE 501.
(3-0-3)

CAE 568
Transportation Asset Management
Process and techniques for managing preservation and expansion of highway transportation facilities such as pavements, bridges, as well as system usage. Five component management systems are examined: pavements, bridges, roadway maintenance, safety and congestions. The methodology for overall transportation asset management is discussed. The primary emphasis is on data collection, life cycle cost analysis, priority setting and optimization, program development strategies, risk an uncertainty modeling and institutional issues. Prerequisite: CAE 419 or instructor's consent.
(3-0-3)

CAE 569
Advanced Heating, Ventilating, and Air-Conditioning
Engineering design and performance analysis procedures for complex commercial building systems, including energy conservation techniques, and a design project. This course will include specific subjects such as spray chambers, cooling towers, Extended Surface Heat Exchangers and also hybrid ventilation. A design of a real commercial Heating, Ventilating, and Air-Conditioning Systems is a major part of this course. Prerequisite: CAE 464 or equivalent, CAE 309 or equivalent, CAE 302 or equivalent.
(3-0-3)

CAE 570/CAE 770
Legal Issues in Civil Engineering
Basics of the legal system, including contracts, torts, land zoning and property ownership. Working knowledge of the law to avoid and mitigate potential legal problems that frequently occur in construction. Contractor liability. Mechanics liens, litigation and arbitration. International construction law, hazardous waste issues and labor law. Prerequisite: CAE 473.
(3-0-3)

CAE 571
Advanced Construction Scheduling and Control
Review of project management principles and network methodologies. Interfacing computerized cost estimating with network scheduling. Claims management with networks. Evaluation and selection criteria for commercially available project-management software. Linear scheduling systems for projects with repetitive characteristics. Acyclic network models. Introduction to expert systems in construction scheduling and control. Prerequisite: CAE 471.
(3-0-3)

CAE 572
Construction Cost Accounting and Control
Review of basic accounting principles and techniquespurchasing, accounts payable, invoicing, accounts receivable, general ledger, payrolls and indirect costs. Job costing and budgeting. Recording and reporting procedures in construction projects invoices, subcontractor applications for payment, labor time cards, unit completion reports, change orders. Cost-coding systems for construction activities. Variance reporting procedures. Project closeout. Class exercise using computer program. Prerequisites: CAE 470, CAE 570.
(3-0-3)

CAE 573
Computer Applications in Construction
Knowledge engineering, human and automated knowledge acquisition and knowledge representation. Inferencing mechanisms. Decisionmaking under uncertainty. Introduction to very high-level programming languages (LISP and Prolog). Review of commercially available expert system shells and development tools for artificial neural network and case-based reasoning applications. Class exercise to construct a system prototype for a civil engineering problem. Prerequisite: CAE 430.
(3-0-3)

CAE 574
Economic Decision Analysis in Civil Engineering
Basic economic concepts, including interest calculations, computation of alternatives, replacements, depreciation and depletion, and tax considerations. Evaluation of public projects, the effect of inflation, decision making under risk and/or uncertainty, economic decision models. Case studies from the civil engineering industry. Prerequisite: CAE 430 or MATH 475.
(3-0-3)

CAE 575
Systems Analysis in Civil Engineering
Management and system concepts, linear and dynamic programming, system modeling by activity networks. Maximal-flow and shortest- path analysis, flow graphs, decision-tree analysis, stochasticnetwork modeling, queuing analysis, and analysis of inventory systems. Case studies from the civil engineering industry. Prerequisites: CAE 430, CAE 471.
(3-0-3)

CAE 576
Advanced Construction Accounting and Finance
Review of sole proprietorships, partnerships, corporations, limited liability companies, federal regular income tax and alternative minimum tax, state income tax, inventories, cash-flow statements, analysis of financial statements. Percentage of completion with look-back and completed contract methods of long-term contract accounting, cost-allocation and equipment-cost-recovery deductions, under federal regular income tax, alternative minimum tax and state income tax rules. International construction issues, including foreign taxes, currencies, tax treaties, income exclusion. Construction claims and effects on accounting. Government construction. Introduction to financing, privatization, nonlump-sum contracts, joint ventures and audits, in accounting and the construction process. Prerequisite: CAE 572.
(3-0-3)

CAE 577
Construction Equipment Management
Factors affecting the selection of construction equipment. Descriptions, operating methods, production rates, unit costs related to excavating equipment. Power shovels, draglines, clam shells, and trenching machines. Engineering fundamentals. Moving construction equipment, including trucks, wagons, scrapers, dozers, soil-stabilization and compaction equipment. Belt conveyors, compaction and drilling equipment, pile driving equipment, pumps and crushers. Prerequisite: CAE 472.
(3-0-3)

CAE 578
Construction Claims Management
Types of contract claims, delays, acceleration, and scope issues. Underlying legal theories of construction contracts and claims, defenses to claims, prophylactic claims measures. The claims process within the contract, extra-contractual basis for claims. Resolution of cliams by ADR techniques, the formal litigation process. AIA, AGC, and federal claims provisions. Other types of claims associated with construction projects such as a surety bond claims and various insurance claims (CGL, Builder's Risk, workers comp, etc). Prerequisite: CAE 473.
(3-0-3)

CAE 579
Real Estate Fundamentals for Engineers and Architects
The objective of this course is to introduce to civil engineering students to the real estate process. Students will learn techniques and methodologies for evaluating real estate investment opportunities using engineering economic analysis principles. Students will use Time Value of Money analysis for evaluating real estate transactions, including hwo to carry out calculations using formulae, financial calculators, and spreadsheets. This course will help civil engineering students learn financial skills that can be applied professionally.
(3-0-3)

CAE 580
Intelligent Transportation Systems
A seminar course on intelligent transportation systems (ITS). the concept of ITS involves the use of rapidly emerging information and communication technologies in mitigating congestion and attendant problems. This course provides an introduction to varous aspects of ITS and focuses on ITS planning, technology, and evaluation. In addition, such topics as deployment, financing and management are also discussed. Prerequisites: CAE 419, CAE 545 or instructor's consent.
(3-0-3)

CAE 581
Algorithms in Transportation
Modeling and analysis of transportation network problems through design, analysis and implementation of agorithms. Emphasis is on the use of quantitative techniques of operations reserach to model system performance. The course covers fundamental datea structures, complexity analysis, memory management, recursive programs, application of graph theory and network analysis to transportation problems, analytical formulations and solution algorithms for traffic assignment problems and dynamic traffic assignment. Prerequisites: CAE 312, CAE 575 or instructor's consent.
(3-0-3)

CAE 582
Structural Wind and Earthquake Engineering
Introduction to nature of wind, aerodynamic wind-loading and design. Strong ground motion phenomenon. Investigation of the response of structures to dynamic and pseudodynamic wind, earthquake, shock waves and other deterministic and probabilistic loadings. Design criteria for buildings and nuclear power stations, special topics in lifeline earthquake engineering. Prerequisite: CAE 420, MMAE 406, or instructor's consent.
(4-0-4)

CAE 583
Special Topics on Earthquake and Wind Engineering
This course covers special topics on earthquake and wind design for buildings and bridges. The course covers eight topics. These topics are independent of each other and cover a variety of engineering applications in earthquake and wind enineering. Prerequisite: instructor's consent.
(2-0-2)

CAE 584
Stormwater Management
Basic principles of stormwater management; hydrology and hydraulics of excess water; excess water management and design; sewer system design and management, storm water detention systems; flood plain system design; risk based design of drainage systems; practical and case study problems.
(3-0-3)

CAE 585
Seismic Design of Building and Bridge Structures
Several specific topics on seismic design of steel and reinforced concrete building and bridge structures are covered. In addition, fundamentals and experiences in seismic design are presented through design examples. Specific emphasis is placed on using various design codes relevant to design of buildings and bridges. Prerequisites: CAE 431 and CAE 432 or instructor's consent.
(3-0-3)

CAE 587
Numerical Methods in Geotechnical Engineering
Constitutive laws of granular and cohesive material, introduction to coupling of water and soil phase in solution, application to problems of consolidation procedures with finite element method. Prerequisites: CAE 562, CAE 442.
(3-0-3)

CAE 588
Theory of Plasticity
Plastic strain, yield criteria, ideal plasticity, hardening and softening, flow theories, Levy-Mises and Prandtl-Reuss relations, Hencky's theory, Drucker's criterion. Modern theories of noncoaxiality. Applications to structures and soils. Same as MMAE 529. Prerequisite: MMAE 530.
(4-0-4)

CAE 589
Groundwater Hydrology and Sampling
Groundwater geology and flow, aquifer and aquitar response of ideal aquifer to pumping. Chemical properties and principles, including source of contamination and estimation of saturated hydraulic conductivity. Principles of exploration and sampling, methods of subsurface explorations, groundwater observation techniques. Prerequisites: CAE 323 and CAE 301 or ENVE 401.
(3-0-3)

CAE 590
Geotechnical Landfill Design and Maintenance
Regulatory and legal issues, site selection and assessment, geotechnical- subsurface investigation, clay mineralogy and clay-waterelectrolyte system, linear and leachate-control-systems design, stability of landfill slopes, cover design, construction and operation, final use and remediation design. Prerequisite: CAE 323.
(3-0-3)

CAE 591
Research and Thesis for M.S. Degree

CAE 593
Civil Engineering Seminar
Reports on current research. Graduate students are expected to register and attend.
(1-0-0)

CAE 597
Special Problems
Subject matter will vary with the interests and background of students and instructor. Design or research problems may be assigned from the areas of construction, geotechnical, geoenvironmental, structural or transportation engineering. Prerequisite: Graduate coursework in the problem subject matter.
(Credit: Variable)

CAE 599
Graduate Workshop
(0-0-0)

CAE 691
Research and Thesis for Ph.D. Degree
(Credit: Variable)

Environmental Engineering Courses

ENVE 485
Pollution Prevention
(Note: This course will be renamed Industrial Ecology). (Co-listed with EM 507) Industrial Ecology is the study of material and energy flows from industrial and consumer activities, and the related regulatory, political, economic, technical, and social issues. Industrial ecologists strive to bring environmental concerns into harmony with economic development. The course includes several projects and readings on current topics such as life cycle analysis (LCA), design for the environment (DFE), and environmental management systems.
(3-0-3)

ENVE 501
Environmental Chemistry
Chemical processes in environmental systems, with an emphasis on equilibrium conditions in aquatic systems. The types of processes examined include acid-base, dissolution-precipitation, air-water exchange and oxidation-reduction reactions. Methods presented for describing chemical speciation include analytical and graphical techniques, as well as computer models. Core course.
(3-0-3)

ENVE 502
Atmospheric Chemistry
The fundamentals and applied aspects of the photochemical processes that drive the daytime chemistry of the lower atmosphere are discussed. Basic chemistry of photochemical smog, acid deposition, and fate of gaseous and airborne toxic chemicals in the atmosphere are presented. An in-depth review of the experimental techniques employed in fundamental and applied studies of reaction in real and simulated atmospheres is also provided. Prerequisites: ENVE 463, ENVE 501.
(2-0-2)

ENVE 503
Water and Wastewater Analysis
Standard and advanced analytical techniques for measuring water quality and efficiencies of water and wastewater treatment processes. Course covers both theoretical and applied aspects of standard methods and advanced techniques for trace metal and organic analyses. Prerequisite: ENVE 501 or consent of instructor.
(2-3-3)

ENVE 504
Advanced Techniques in Environmental Analysis
Principles and applications of advanced techniques in analytical chemistry appropriate to environmental surveillance and control. Includes pesticide analysis, trace metal identification, and automated photometric techniques. Prerequisite: ENVE 501 or consent of instructor.
(2-3-3)

ENVE 505
Principles of Water Chemistry
Examination of current research theories and state-of-the-art in subjects pertinent to the chemical aspects of environmental science. Includes chemistry of humic substances and of pesticides in natural waters; physical, chemical and biological fates of trace metals and organic pollutants, and chemistry of biological nutrients. Prerequisite: ENVE 501 or consent of instructor.
(3-0-3)

ENVE 506
Chemodynamics
The dynamics of pollutant transfer in biogeochemical systems of the earth. The overall objective of this course is to introduce fundamental science and engineering principles needed to formulate creative, comprehensive solutions to transport problems; critically evaluate proposed solutions to transport problems; and acquire and integrate new information to build on these fundamentals. Core course.
(3-0-3)

ENVE 509
Special Topics in Environmental Chemistry
Lectures and field studies on topics pertinent to the chemical aspects of environmental systems. May be repeated with change of course content, up to a maximum of six credits. Prerequisite: consent of instructor.
(Credit: 13 hours.)

ENVE 510
Environmental Biodynamics
Properties and characteristics of microorganisms as they relate to water quality and to treatment processes. Batch population growth characteristics. Microbial degradation of organic compounds. Microbial pathogens of waterborne diseases and microbial indicators. Biogeochemical relations.
(3-1-4)

ENVE 512
Biotechnological Processes in Environmental Engineering
Fundamentals and applications of biological mixed culture processes for air, water, wastewater and hazardous waste treatment. Topics include biochemical reactions, stochiometry, enzyme and microbial kinetics, detoxification of toxic chemicals, and suspended growth and attached growth treatment processes. The processes discussed include activated sludge process and its modifications, biofilm processes including trickling filters and biofilters, nitrogen and phosphorous removal processes, sludge treatment processes including mesophilic and thermophilic systems, and natural systems including wetlands and lagoons. Prerequisite: ENVE 542 or consent of instructor.
(3-0-3)

ENVE 520
Environmental Monitoring and Assessment
Modeling and monitoring methods for the prediction and assessment of environmental impacts due to changes in the physical, chemical and biological environment. Comparative studies of methodologies to assess immediate and extended effects, including trends in space and time due to changes in anthropogenic systems. Dynamics of environmental changes, inventory methods and priority impact criteria. Same as ENVE 405.
(3-0-3)

ENVE 525
Advanced Water Resources
Water resources engineering, including hydrology, quality standards, groundwater flow and surface hydraulics. Optimization and allocation of water resources. Prerequisite: ENVE 401.
(3-0-3)

ENVE 527
Statistical Analysis of Systems
Multivariate probability distributions. Inference about mean, variance. Multivariate linear regression and response surface analysis. Principal components analysis, factor analysis, canonical correlation analysis. Clustering, discrimination and classification. Selected advanced topics such as survey design, design of experimental techniques, statistical methods for discrete and binary variables, time series analysis, partial least squares techniques. Prerequisites: CHE 426, ENVE 426. Same as CHE 533.
(3-0-3)

ENVE 528
Modeling of Environmental Systems
To introduce students to mathematical modeling as a basic tool for problem solving in engineering and research. Environmental problems will be used as examples to illustrate the procedures of model development, solution techniques and computer programming. These models will then be used to demonstrate the application of the models, including simulation, parameter estimation and experimental design. The goal is to show that mathematical modeling is not only a useful tool, but also an integral part of process engineering.
(3-0-3)

ENVE 532
Special Topics in Environmental Engineering
Lectures and discussion on topics pertinent to the engineering aspects of environmental systems. May be repeated with change of course up to a maximum of six credits. Prerequisite: consent of instructor.
(Credit: 13 hours.)

ENVE 542
Physicochemical Processes in Environmental Engineering
Fundamentals and applications of physicochemical processes used in air, water, wastewater and hazardous waste treatment systems. Topics include reaction kinetics and reactors, particle characterization, coagulation and flocculation, sedimentation, filtration, membrane separation, adsorption and absorption. Prerequisite: ENVE 404 or consent of instructor. Co-requisite: ENVE 501 or consent of instructor. Core course.
(3-0-3)

ENVE 544
Energy, Environment and Economics
The linkage of energy, environmental and economic issues. The impact of energy supply and end-use on human well-being and the ecosystem. A comprehensive approach to the resolution of resource, technical, economic, strategic, environmental, socio- and geopolitical problems of the energy industries. Pathways to a sustainable global energy system. Same as CHE 543.
(3-0-3)

ENVE 545
Environmental Regulations and Risk Assessment
One third of the course is a review of current environmental regulations, including the Clean Air Act, Clean Water Act, Toxic Substances Control Act, Resource Conservation and Recovery Act, CERCLA, and the Pollution Prevention Act. The rest of the course deals with the fundamentals of risk assessment, including hazard identification, dose-response assessment, exposure assessment and risk characterization for public health and ecosystems.
(3-0-3)

ENVE 546
Industrial Hygiene
An introduction to toxicology, exposure routes and physiological classification of toxicants. Epidemiological considerations, measurement methods, strategies and calculations. Modeling of exposures and evaluation of controlling parameters. Ventilation methods of control. Physical stressors of sound, heat, vibration and lifting. Methods for measurement and calculation of exposure/compliance levels.
(3-0-3)

ENVE 551
Industrial Waste Treatment
Industrial waste sources and characteristics, significance of industrial wastes as environmental pollutants; applications of standard and special treatment processes, including physical, chemical and biological systems. Prerequisite: ENVE 513, ENVE 542 or consent of instructor.
(3-0-3)

ENVE 555
Industrial Waste Treatment Design Criteria
Theoretical and laboratory development of industrial wastewater treatment systems design criteria. Evaluation and selection of unit treatment processes. Application of design procedures for selected representative industrial wastewater. Prerequisites: ENVE 513, ENVE 542 or consent of instructor.
(2-3-3)

ENVE 561
Design of Environmental Engineering Processes
Design of water and wastewater treatment systems. System economics and optimal design principles. Prerequisite: ENVE 513, ENVE 542 or consent of instructor.
(3-0-3)

ENVE 563
Systems Engineering: Waste Facility Design and Operation
Fundamentals of systems engineering applied to wastewater facility design and operation. Modeling, simulation, optimization, techniques for biological and physicochemical treatment processes. Process analysis and control simulations, cost optimization. Prerequisite: ENVE 404 or consent of instructor.
(3-0-3)

ENVE 570
Air Pollution Meteorology
Physical processes associated with the dispersion of windborne materials from industrial and other sources. Atmospheric motion, including turbulence and diffusion, mathematical models and environmental impact assessment. Global climate change, ozone depletion, acid rain are studied. Prerequisite: ENVE 513, ENVE 542 or consent of instructor.
(3-0-3)

ENVE 572
Ambient Air Monitoring
Ambient air sampling and pollutant analysis. Methods for collection and identification of gaseous and particulate pollutants. Air monitoring survey design, instrument calibration, interpretation of atmospheric data. Prerequisites: ENVE 501, ENVE 570.
(2-3-3)

ENVE 573
Air Pollution Engineering
Air pollution sources and source control, chemistry and meteorology of the atmosphere, atmosphere diffusion and stack performance, equipment and engineering processes for air emission control. Prerequisite: ENVE 463.
(3-0-3)

ENVE 574
Stack Sampling and Analysis
Current practices of measuring pollutants emitted from stationary sources. Methods of collection and analysis of stack effluents, including field-sampling techniques and data evaluation.
(2-3-3)

ENVE 575
Control of Toxic Air Pollution
Definition of toxic air pollutants; sources of toxic air pollutants; emissions measurement, air dispersion and deposition models; risk assessment and risk management; ecological risk analysis, gaseous toxic air pollutant control technologies; fugitive emissions control. Pollution prevention. Prerequisite: consent of instructor.
(3-0-3)

ENVE 576
Indoor Air Pollution
Indoor air pollution sources, indoor pollutant levels, monitoring instruments and designs; indoor pollution control strategies: source control, control equipment and ventilation; energy conservation and indoor air pollution; exposure studies and population time budgets; effects of indoor air pollution; risk analysis; models for predicting source emission rates and their impact on indoor air environments. Prerequisite: ENVE 405, ENVE 520 or consent of instructor.
(3-0-3)

ENVE 577
Design of Air Pollution Control Devices
Principles and modern practices employed in the design of engineering systems for the removal of pollutants. Design of control devices based on physical and chemical characteristics of polluted gas streams. Prerequisite: ENVE 463.
(3-0-3)

ENVE 578
Physical and Chemical Processes for Industrial Gas Cleaning
Application of physical and chemical processes in the design of air treatment systems; fundamentals of standard and special treatment processes. Prerequisite: ENVE 463.
(3-0-3)

ENVE 580
Hazardous Wastes Engineering
Sources and characteristics of hazardous wastes, legal aspects of hazardous waste management, siginificance of hazardous wastes as air, water and soil pollutants. Principles and applications of conventional and specialized hazardous waste control technologies. Prerequisites: ENVE 501 and ENVE 506, or consent of instructor. Core course.
(3-0-3)

ENVE 585
Groundwater Contamination and Pollutant Transport
Applications of groundwater flow principles, transport phenomena, and chemical and biological processes to problems of groundwater contamination. Simulation model and case studies of current topics.
(3-0-3)

ENVE 590
Environmental Engineering Seminar
Presentations on recent developments in the field by academic and industrial visitors.
(1-0-1)

ENVE 591
Research and Thesis for MS Degree

ENVE 597
Special Problems
Independent study and project.
(Variable Credit)

ENVE 691
Research and Thesis for PhD. Degree

Department of Computer Science

Stuart Building
10 W. 31st St.
Chicago, IL 60616
312.567.5150
312.567.5067 fax
www.iit.edu/csl/cs
info@cs.iit.edu

Chair:
Xian-He Sun

Associate Chair:
Cynthia Hood

The study of computer science is the inquiry into the nature of computation and its use in solving problems in an information-based society. Computer science is an evolving discipline, but it has a well-defined core of knowledge and a set of characteristic methodologies. The methods and skills required of the computer scientist include formalization and abstraction, algorithm design, programming, organization of unstructured knowledge, modeling, language development, and software system architecture and design. The graduate program in computer science at IIT stresses high achievement in both fundamental knowledge and practical problem solving. It offers the student a solid background in the core areas and exposure to cutting-edge computer technologies.

Degrees Offered

Master of Computer Science
Master of Computer Science with specialization in:

- Business
- Computer Networking and Telecommunications
- Information Systems
- Software Engineering

Master of Science in Computer Science
Master of Science for Teachers
Doctor of Philosophy in Computer Science

Joint- and Dual-Degree Programs

With the Department of Electrical and Computer Engineering:
Master of Telecommunications and Software Engineering

With the Department of Chemical and Biological Engineering:
Master of Science in Computer Science/ Master of Chemical Engineering

Certificate Programs

Computer Networking and Telecommunications
Information Systems
Software Engineering

Research Facilities

The department has research computing facilities that include Sun SPARC and Silicon Graphics UNIX workstations, and Windows-based PCs. The department also has facilities for research in parallel computing. The equipment includes a large scale Sun "ComputeFarm" consisting of 172 processors and 562 cores connected via a Linux-based IBM cluster, an Opteron cluster from Microsoft and a Cray XDI supercomputer connected Management. An advanced technology Access Grid node has been installed by the department, which allows researchers, teachers and students at different locations worldwide to interact via a network multimedia environment.

Research Areas

Algorithms, data structures, artificial intelligence, computer architecture, computer graphics, computer networking and telecommunications, computer vision, database systems, distribued and parallel processing, I/O systems, image processing, information retrieval, natural language processing, software engineering, and system software.

Faculty

Gady Agam, Associate Professor. B.Sc., M.Sc., Ph.D., Ben-Gurion University. Computer vision, computer graphics, image processing, pattern recognition, machine learning, geometric modeling, medical imaging, document imaging.

Shlomo Argamon, Associate Professor. B.S. Carnegie-Mellon University, M.Phil, Ph.D. Yale University. Machine Learning, computational linguistics, stylistics, information retrieval.

Charles Bauer, Professor Emeritus. B.S., M.Ed., Loyola University. Computer Education, computers used in education, distance learning, computer-based educational technology, computer learning, teacher training.

Mustafa Bilgic, Assistant Professor. B.S., University of Texas; M.S., Ph.D., University of Maryland. Data mining, machine learning, probabilisic graphical models, statistical relational learning, active learning, social network analysis, information visualization.

Ilene Burnstein, Professor Emerita. B.S., Brooklyn College; M.S., University of Maryland; Ph.D., Illinois Institute of Technology. Software engineering, knowledge-based testing and debugging tools, test process assessment and improvement models, capability maturity models.

Gruia Calinescu, Associate Professor. Diploma, University of Bucharest (Romania); Ph.D., Georgia Institute of Technology. Algorithms, approximation algorithms, optical and wireless, ad-hoc networks.

C. Robert Carlson, Professor, Dean, School of Applied Technology. B.A., Augustana College; M.S., Ph.D., University of Iowa. Information architecture, object-oriented modeling and design, software maturity models.

Edward Chlebus, Industry Associate Professor., Ph.D., Cracow University, Network modeling, performance evaluation and tele-traffic analysis.

Tzilla Elrad, Research Professor. B.S., Hebrew University (Israel); M.S., Syracuse University; Ph.D., Technion Israel Institute of Technology (Israel). Concurrent programming, formal verification, embedded real-time systems and ADA standards.

Martha Evens, Professor Emerita. A.B., Bryn Mawr College; A.M., Radcliffe College; Ph.D., Northwestern University. Natural language processing, expert systems and intelligent tutoring/information systems.

Ophir Frieder, Professor. Ph.D., University of Michigan. Parallel and distributed information retrieval systems, communication systems, high performance database systems, biological and medical data processing architectures.

Peter Greene, Professor Emeritus. A.B., Amherst College; Ph.D., University of Chicago. Neural networks, feeling-based reasoning, artificial intelligence and robotics.

David Grossman, Associate Professor. B.S., Clemson University; M.S., American University; Ph.D., George Mason University. Information retrieval, data mining, integration of structured data and text.

Cynthia Hood, Associate Professor and Associate Chair. B.S., Rensselaer Polytechnic Institute; M.E., Stevens Institute of Technology; Ph.D., Rensselaer Polytechnic Institute. Network management, statistical signal processing, learning processing.

Sanjiv Kapoor, Professor. B.Tech., Indian Institute of Technology, Delhi (India); Ph.D., University of Illinois, Urbana-Champaign. Computational geometry, graph algorithms, combinatorial optimization, graphics, data structures.

Bogdan Korel, Associate Professor and Associate Chairman. M.S., Technical University of Kiev (Ukraine); Ph.D., Oakland University. Software engineering, automated software testing and analysis.

Zhiling Lan, Associate Professor, B.S. Beijing Normal University, M.S. Chinese Academy of Sciences, Ph.D., Northwestern University. Parallel and distributed computing, performance analysis and modeling.

Xiang-Yang Li, Associate Professor. B.S., B.M., Tsinghua University, Beijing (China); M.S., Ph.D., University of Illinois, Urbana-Champaign. Algorithm design and analysis, system design for wireless ad hoc and sensor networks, network information theory, security protocols, and computational geometry

Ioan Raicu, Assistant Professor. B.S., M.S., Wayne State University; Ph.D., University of Chicago. Distributed Systems, high-throughput and high-performance computing, efficient task dispatch and execution systems, resource provisioning, data management, scheduling, performance evaluations in distributed systems.

Edward M. Reingold, Professor. B.S., Illinois Institute of Technology; M.S., Ph.D., Cornell University. Analysis of algorithms, data structures, combinatorial algorithms, mathematics, history, and computer implementation of calendars.

Shangping Ren, Associate Professor. Ph.D., University of Illinois, Urbana-Champaign. Domain specific computing (including distributed computing, real-time computing, and mobile computing), and domain specific programming abstractions (such as language abstractions for real-time systems, for context-aware adaptive mobile systems, and for coordination among distributed asynchronous entities).

Xian-He Sun, Professor and Chair, Ph.D., Michigan State University. Distributed and parallel processing, software systems, I/O systems, peformance evaluation, scientific computing.

Peng-Jun Wan, Professor. B.S., Tsinghua University (China); M.S., Institute of Applied Mathematics, Chinese Academy of Sciences (China); Ph.D., University of Minnesota. Interconnection design, routing and resource management in optical networks, low-earth orbit satellite networks, wireless local area networks.

Wai Gen Yee, Visiting Assistant Professor. B.S. University of Chicago, M.S., Ph.D. Georgia Institute of Technology. Database systems, mobile and distributed computing.

Hong Zhang, Research Professor. Ph.D., Michigan State University. Application software development, scientific and parallel computation, computer modeling and simulation, and numerical analysis.

Admission Requirements

Cumulative undergraduate GPA minimum: 3.0/4.0
Cumulative Master of Science GPA minimum (for Ph.D. applicants): 3.5/4.0
GRE minimum combined (quantitative/verbal/analytical) score for tests taken prior to Oct.1, 2002:
M.S.: 1400
MAS : 1200
Ph.D.: 1600, with a minimum in the 70th percentile of the quantitative section
GRE minimum score for tests taken on or after Oct.1, 2002:
M.S.: 1000 (quantitative + verbal) 3.0 analytical writing
MAS: 900 (quantitative + verbal) 2.5 analytical writing
Ph.D.: 1100 (quantitative + verbal) 3.5 analytical writing, with a minimum in the 70th percentile of the quantitative section
TOEFL score (international students from non-English speaking countries): 550/213/80*

Meeting the minimum GPA and test score requirements does not guarantee admission. Test scores and GPA are just two of several important factors considered. Applicants to masters degree programs in computer science should hold a bachelors degree in computer science with a minimum overall GPA of 3.0/4.0 or its equivalent. For international students from non-English speaking countries, a minimum TOEFL score of 550/213/80 is required. All applicants must submit scores from the GRE general test. (The GRE requirement is waived for applicants to the Master of Computer Science program who hold bachelors degrees from accredited U.S. institutions with a minimum cumulative GPA of 3.0/4.0.) Applicants with bachelors degrees in other disciplines can be admitted to Master of Science or Master of Computer Science programs. However, students whose training does not include the equivalent of CS 201 (Accelerated Introduction to Computer Science), CS 330 (Discrete Structures), CS 331 (Data Structures and Algorithms), CS 350 (Computer Organization and Assembly Language Programming) and CS 351 (Systems Programming) will be required to complete all of the courses in which a deficiency exists. Some students may be able to complete their deficiencies with the following six-credit hour sequence with grades of "B" or better.:

CS 401	Introduction to Advanced Studies I
CS 402	Introduction to Advanced Studies II

In addition, students who have not had at least one course in calculus will be required to take a calculus course.

Applicants to the Ph.D. program should hold an M.S. degree in computer science with a minimum GPA of 3.0/4.0 for their bachelors degree and 3.5/4.0 for their M.S. degree, or a minimum GPA of 3.5/4.0 for their bachelors degree if they apply without a M.S. degree. For non-English speaking applicants without a U.S. degree, a minimum TOEFL score of 550/213/80 is required.

* Paper/computer/internet-based test score.

Master of Computer Science

30 credit hours

This Professional Master's degree program consists of 30 credit hours of coursework in computer science. This program is designed for those without a prior degree in computer science, or those who are primarily interested in a (non-thesis) program preparing them for careers as working computer science professionals in business and industry. A full-time student enrolled in the program should be able to complete the requirements in 1 to 1.5 years. Specializations in business, software engineering, networking and telecommunications and information systems are available. Admission requirements include:

Bachelor's degree from an accredited university with a minimum cumulative GPA of at least 3.0/4.0. Combined verbal and quantitative GRE examination score of at least 900 and an analytic writing score of at least 2.5, for the post-October 2002 test. The GRE requirement is waived for students with a bachelor's degree from an accredited college or university in the United States with a cumulative GPA of at least 3.0/4.0.

Prerequisites include knowledge of a high level programming language at the level of CS 201 (Java or C/C++ programming is required). Students with insufficient background in computer science will be required to take CS 401 and CS 402 (Introduction to Advanced Studies I and II) and to earn at least a B in these courses. These prerequisite courses do not count toward the 30 credit hour requirement.

A maximum of 12 credit hours of 400-level courses and a maximum of 6 credit hours of accelerated courses are allowed as part of the 30 credit hours requirement. Twenty hours of coursework must be in CS or CSP (CS Professional) courses at the 500 level.

Students are required to take at least one course in each of the three core areas (Programming, Systems, and Theory).

Programming core courses

CS 522 Data Mining
CS 525 Advanced Database Organization
CS 529 Information Retrieval
CS 540 Syntactic Analysis of Programming Languages
CS 546 Parallel Processing
CS 551 Operating System Design and Implementation

Systems core courses

CS 542 Computer Networks I: Fundamentals
CS 544 Computer Networks II: Network Services
CS 547 Wireless Networking
CS 550 Advanced Operating Systems
CS 555 Analytic Models and Simulation of Computer Systems
CS 570 Advanced Computer Architecture
CS 586 Software Systems Architecture

Theory core courses

CS 530 Theory of Computation
CS 532 Formal Languages
CS 533 Computational Geometry
CS 535 Design and Analysis of Algorithms
CS 536 Science of Programming
CS 538 Combinatorial Organization

Master of Science in Computer Science/Master of Chemical Engineering

44 credit hours

This combined program in computer science and chemical engineering addresses the growing need for process engineers with expertise in computational modeling and simulation of chemical processes. Similarly, the program provides strong engineering background that is required today in many areas of computer science. The program is jointly offered by the Department of Computer Science and the Department of Chemical and Environmental Engineering. Students in this program earn both Master of Science in Computer Science and Master of Chemical Engineering degrees.

Students must fulfill the core course requirements of both departments. Students are required to take 18 credit hours in graduate chemical engineering courses (courses numbered 500 or higher) and 26 credit hours in computer science courses (of which 20 credit hours must be 500- level courses). The 18 credit hours in chemical engineering courses consist of 12 credits in core courses listed in the description of the Master of Chemical Engineering requirements and six credit hours from the following courses:

CHE 507 Computer-Aided Design
CHE 508 Process Design Optimization
CHE 528 Analysis and Simulation of Chemical Processing
CHE 532 Process Modeling
CHE 533 Statistical Analysis Of Systems
CHE 536 Computational Techniques in Engineering
CHE 560 Statistical Quality and Process Control

Master of Computer Science with Specialization in Business

33 credit hours

This program is designed to help computer science professionals extend and deepen their technical and practical knowledge of the field while introducing themselves to core topics in modern business practices. To complete the program students must satisfy Master of Computer Science requirements and also take four specialization courses from the Stuart School of Business:

MBA 501 Financial and Managerial Accounting
MBA 503 Organizational Behavior
MBA 505 Managerial Economics
MBA 509 Managerial Finance
MBA 511 Marketing Management

Note: Stuart School of Business tuition and fees apply to these courses. Applicants to the program are not required to take the GMAT.

Master of Computer Science with Specialization in Computer Networking

30 credit hours

This program is designed to provide an in-depth knowledge of the theories and practices in computer networking and telecommunications. Students must satisfy Master of Computer Science requirements and are also required to select four specialization courses. Note that CS 542, CS 544, and CS 547 also count as Systems core courses.

Specialization courses

CS 542 Computer Networks I: Fundamentals
CS 544 Computer Networks II: Network Services
CS 547 Wireless Networking
CS 548 Broadband Networks
CS 549 Cryptography and Network Security
CS 555 Analytic Models and Simulation of Computer Systems

Master of Computer Science with Specialization in Information Systems

30 credit hours

This program is designed to provide in-depth knowledge of the principles of design and development of information systems. Students must satisfy Master of Computer Science requirements and are also required to select four specialization courses. Note that CS 522, CS 525, and CS 529 also count as Programming core courses.

Specialization courses

CS 521 Object-Oriented Analysis and Design
CS 522 Data Mining
CS 525 Advanced Database Organization
CS 529 Information Retrieval
CS 545 Distributed Computing Landscape

Master of Computer Science with Specialization in Software Engineering

30 credit hours

This program is designed to provide an in-depth knowledge of theory and practices in software engineering, including hands-on experience in software design, development and maintenance. Students must satisfy Master of Computer Science requirements and are also required to select four specialization courses. Note that CS 536 and CS 586 also count as Theory and Systems core courses respectively.

Specialization courses

CS 536 Science of Programming
CS 537 Software Metrics
CS 586 Software System Architectures
CS 587 Software Project Management
CS 588 Advanced Software Engineering Development
CS 589 Software Testing and Analysis

Master of Science in Computer Science

32 credit hours

The purpose of this program is to prepare students for the Ph.D. program and/or a research/development career in the industry in the field of computer science. Students have the option to pursue thesis research or a project under the guidance of a faculty advisor.

Program Requirements

All programs require a core curriculum of 12 credit hours and 20 credit hours of elective courses, which may include a thesis or project. If a thesis or project is included in the program, the student, with a faculty advisor, develops a program of study that specifies the supportive and elective program and describes the thesis or project. The program of study must consist of at least 32 credit hours, at least 20 of which must be 500-level computer science courses. Up to six credits of accelerated courses may be applied to the degree. (Students should see the definition of "accelerated courses" below.)

A student may choose from three options to complete the degree:

Option 1: Master's thesis: Coursework and up to five hours of CS 591 for a total of 32 hours. The result is a master's thesis.

Option 2: Master's project: coursework and up to five hours of CS 597 for a total of 32 hours. The result is a project that results in one of the following:

1. A high-quality paper submitted for publication as an article or as a technical report.
2. A high-quality piece of software. The software should be of distribution quality, but can be proprietary.

Option 3: 32 credit hours of coursework. A student must complete 32 hours of regular coursework including electives and core courses with a GPA of 3.0/4.0 or better.

Students are required to take courses in three core areas: Programming, Systems, and Theory. The student must take at least one course from the Programming area, at least one course from the Systems area, and at least two courses from the Theory area. The list below contains the core course offerings in the M.S. program:

Programming core courses

CS 522 Data Mining
CS 525 Advanced Database Organization
CS 529 Information Retrieval
CS 540 Syntactic Analysis of Programming Languages
CS 546 Parallel Processing
CS 551 Operating System Design and Implementation

Systems core courses

CS 542 Computer Networks I: Fundamentals
CS 544 Computer Networks II: Network Services
CS 547 Wireless Networks
CS 550 Advanced Operating Systems
CS 555 Analytic Models and Simulation of Computer Systems
CS 570 Advanced Computer Architecture
CS 586 Software Systems Architectures

Theory core courses

CS 530 Theory of Computation
CS 532 Formal Languages
CS 533 Computational Geometry
CS 535 Design and Analysis of Algorithms
CS 536 Science of Programming
CS 538 Combinatorial Optimization

Master of Science for Teachers (M.S.T).

32 credit hours
Comprehensive exam (project)

The M.S.T. is designed for experienced teachers or training officers to strengthen their academic background in a rapidly changing discipline. The program, though flexible enough to meet a variety of needs, also requires substantive coursework in the core of computer science. The student, with a faculty advisor, develops a program of study, describes the project, and specifies an elective program, which must be approved by the faculty of the department.

The program of study consists of 32 credit hours, at least 20 hours of which must be 500-level courses. It also includes an M.S.T. project that deals with some aspect of computer science or with computer science applied to some other academic discipline. To be awarded the M.S.T. degree, the student must satisfactorily complete the program of study and pass a project defense examination, which consists of an oral defense of the project. Of the 32 credit hours, 12 credit hours must be from the courses listed below:

CS 485 Computers in Society
CS 560 Computer Science in the Classroom
CS 561 The Computer and Curriculum Content
CS 565 Computer-Assisted Instruction
CS 566 Practicum in the Application of Computers to Education

Master of Telecommunications and Software Engineering (M.T.S.E.)

30 credit hours

The Master of Telecommunications and Software Engineering (M.T.S.E.) is a course-only degree program that prepares students for professional practice in telecommunications and information technologies. The program, jointly offered by the Electrical and Computer Engineering (ECE) and Computer Science (CS) departments, can be completed in one year of full-time study.

Admission Requirements

A person holding a B.S.E.E., B.S.C.P.E. or B.S.C.S. degree has the necessary broad background to undertake the M.T.S.E. program. A student without adequate background in specific areas is required to demonstrate proficiency in prerequisite courses; an abbreviated list is given below.

Specific proficiency courses will be detailed for each student at the time of admission to the M.T.S.E. program. Proficiency in a course may be demonstrated by completing the course with a grade of A or B, or by achieving a grade of A or B in a proficiency examination administered by the ECE or the CS department. Students should contact the departmental advisor for more details on prerequisites and proficiency requirements.

Students interested in the M.T.S.E. degree whose B.S. degree is not in electrical engineering, computer engineering, or computer science should contact the departmental advisor before applying.

Computer Science Prerequisites

CS 201 Accelerated Introduction to Computer Science
CS 401 Introduction to Advanced Studies

Electrical and Computer Engineering Prerequisites

ECE 211 Circuit Analysis I
ECE 213 Circuit Analysis II
ECE 308 Signals and Systems
MATH 252 Introduction of Differential Equations

Program Requirement

The M.T.S.E. is a professional master's degree requiring a minimum of 30 credit hours of advisor-approved coursework. The M.T.S.E program of studies must include a minimum of 12 credit hours of ECE coursework and a minimum of 12 credit hours of CS coursework. Four required courses and one elective course from each of the three categories given below must appear on the M.T.S.E. program of studies.

Required courses

CS 586 Software Systems Architecture
CS 587 Software Project Management
ECE 513 Communication Engineering Fundamentals
ECE 541 Performance Evaluation of Computer Networks

Elective categories

I. Software Engineering

CS 521 Object-Oriented Information Systems
CS 537 Software Metrics
CS 589 Software Testing and Analysis

II. Telecommunication Systems

CS 544 Computer Networks II: Network Services
CS 548 Broadband Networks
CS 555 Analytic Models and Simulation of Computer Systems
ECE 545 Advanced Communication Networks

III. Telecommunications

ECE 504 Wireless Communication System Design
ECE 515 Modern Digital Communications
ECE 519 Coding for Reliable Communications

The remaining nine credits of coursework may be taken from courses listed above, or other courses approved by the M.T.S.E. advisor. Students with no background in communications or software engineering should consider including in their programs of study:

CS 450 Operating Systems
CS 455 Data Communications
CS 487 Software Engineering
ECE 403 Communications Systems

Other courses that students in this program typically choose from include:

ECE 437 Digital Signal Processing I
ECE 511 Analysis of Random Signals
ECE 514 Digital Communication Principles
CS 542 Computer Networks I: Fundamentals
CS 588 Advanced Software Engineering Development

With advisor approval, the M.T.S.E. program can include up to two credit hours of Master's Seminar (ECE 595, ECE 596). It can also include up to four credits of accelerated courses.

Doctor of Philosophy

85 credit hours if without M.S. degree; 54 credit hours if with M.S. degree.
Qualifying exam
Comprehensive exam
Dissertation and oral defense

The Ph.D. is awarded in recognition of a significant original contribution to one of the fields of computer science and a high level of mastery in several fields of computer science and a significant original contribution to one of those fields. Students work with faculty members to develop programs to match individual interests. The goal is to develop computer scientists who can take complex, undefined problems and restructure and resolve them through imaginative application of their knowledge. Graduates typically go on to teaching and/or research positions in industry and universities. The degree normally requires three to four years beyond the master's degree for full-time students. Part-time students can also enter the program but will need more time to complete the degree. Generally, students can enter the program with either a B.S. degree or an M.S. degree in related fields. The requirements of the Ph.D. program are described separately as follows.

Requirements for students entering with B.S. Degree

85 credit hours
Qualifying exam
Comprehensive exam
Dissertation and oral defense

The Ph.D. (post B.S.) program (called the direct Ph.D. program) encourages bright and highly motivated students to participate in a research program immediately after the B.S. degree.

Admission Requirements

The applicants should have a B.S degree in computer science. Admission to the program is competitive and depends on a student's GRE score and it is expected that applicants will have a high grade-point average. For non-English speaking applicants without a U.S. degree, a minimum TOEFL score of 550 is required. If the TOEFL score is less than 600, the applicant is required to take the English Proficiency Exam administered by the IIT Humanities Department. Applicants must submit three letters of recommendation.

Requirements for Entering with an M.S. Degree

54 credit hours
Qualifying exam
Comprehensive exam
Dissertation and oral defense

Admission Requirements

The applicants should have an M.S degree in computer science or related fields. Admission to the program is competitive and depends on a student's GRE score and it is expected that applicants will have a high grade-point average. For non-English speaking applicants without a U.S. degree, a minimum TOEFL score of 550 is required. If the TOEFL score is less than 600, the applicant is required to take the English Proficiency Examination administered by the IIT Humanities Department. Applicants must submit three letters of recommendation.

Program Requirements (for students with a B.S. Degree)

The program requires students to complete at least 85 and at most 128 advisor-approved semester credit hours of study. This must include

- 0-12 credits of 400-level courses
- 36-54 credits of 500- and 600- level courses. Among them, at most 6 credits come from outside the Computer Science Department of IIT. Credits from CS 595 are allowed.
- 6-12 credits of CS 597 (Reading and Special Problems)
- 24-48 credits of CS 691 (Research/Thesis for Ph.D. degree). Note CS 691 can only be taken after passing the Ph.D. qualifying exam.
- 1 credit of Ph.D. seminar

Notice that no credits will be given to accelerated courses (700-level courses). No credits are given to courses in which the student earns a grade of C or below. The student may have to take some other courses as required by the advisor. The credit hours of 500-level coursework must include five core courses with at least one each from Groups I, II, and III described below and at least one course from each of two different groups from among Groups IV, V, and VI. Advanced courses may be substituted after approval of the department. The groups of core courses are:

Group I: Theory of Computation

CS 530 Theory of Computation
CS 533 Computational Geometry
CS 535 Design and Analysis of Algorithms
CS 538 Combinatorial Optimization

Group II: Systems

CS 546 Parallel Processing
CS 550 Advanced Operating Systems
CS 570 Advanced Computer Architecture

Group III: Programming Languages

CS 536 Science of Programming
CS 541 Topics in Compiler Construction
CS 545 Distributed Computing Landscape

Group IV: Networks

CS 542 Computer Networks I: Fundamentals
CS 544 Computer Networks II: Network Services

Group V: Databases

CS 525 Advanced Database Organization

Group VI: Software Engineering

CS 586 Software Systems Architectures

M.S. Exit from Program

Students wishing to leave the direct Ph.D. program with the degree of Master of Science in Computer Science must satisfy all the requirements of the Master's degree and either write an M.S. thesis or pass the Ph.D. qualifying examination.

Ph.D. Qualifying Examination

The Ph.D. Qualifying Exam has two parts: a written examination and an oral examination. The written examination is used to judge a student's breadth of knowledge; the oral examination is used to judge a student's research potential. The first attempt in oral examination and the written examination must be taken no later than a student's 5th semester. The second attempt must be taken no later than a student's 6th semester. These requirements hold for both full-time and part-time students The written examination is divided into three, independent area examinations. To pass the written examination, a student must pass all the area examinations.

Extra coursework cannot be used in lieu of passing an area examination. Area examinations can be taken in the same or different semesters. A student who fails an area examination can retake the area examination, but only once. See the computer science webpage for more detail of qualifying examinations.

Comprehensive (Research Proposal) Examination

The purpose of the Comprehensive Examination is to ensure that the candidate has the background to carry out successful research in the chosen area and that the research problem is properly formulated and has sufficient scholarly merit. The student (in concert with the student's research advisor) must develop a written research proposal containing a literature review, a proposed research topic, and a program of research based upon this topic, and then present the proposal orally as well.

The student must request appointment of an examination committee using Form 301. The examination committee may consist of from four to seven members. It must include at least three full-time faculty members from the Computer Science Department and one full-time faculty member from another department in the university Other committee members from inside or outside the university may be chosen. The student should consult with his/her research advisor concerning the makeup of the committee.

Thesis Defense

Each student must present an oral defense of his/her Ph.D. Thesis. The Thesis Review Committee is appointed in much the same way as the Ph.D. Comprehensive Examination Committee. It will examine the written thesis and examine the student during the oral defense. All Ph.D. Thesis Defenses are open to the public.

Program Requirements (for students with an M.S. Degree)

If the student has an M.S. degree in computer science, the program requires the student to complete at least 54 advisor-approved semester credit hours of study. This must include

- 0-12 credits of 400-level courses
- 18-30 credits of 500- and 600-level courses. Amongst them, at most 6 credits come from outside the computer science department. Credits from CS 595 are allowed.
- 3-12 credits of CS 597 (Reading and Special Problems)
- 24-48 credits of CS 691 (Research/Thesis for Ph.D. degree). Note CS 691 can only be taken after passing the Ph.D. qualifying exam.
- 1 credit of Ph.D. seminar

Notice that no credits will be given to accelerated courses (700-level courses). No credits are given to courses in which the student earns a grade of C or below. The student may have to take some other courses as required by the advisor. The credit hours of 500-level coursework must include three core courses with at least one each from Groups I, II, and III described before. Advanced courses may be substituted after approval of the department.

If the student has an M.S. degree in a field other than computer science, the program requires the student to complete at least 60 advisor-approved semester credit hours of study. This must include:

- 0-12 credits of 400-level courses
- 24-30 credits of 500- and 600-level courses. Among them, at most 6 credits may come from outside the computer science department. Credits from CS595 are allowed.
- 3-12 credits of CS 597 (Reading and Special Problems)
- 24-48 credits of CS 691 (Research/Thesis for the Ph.D. degree). Note CS 691 can only be taken after passing the Ph.D. qualifying exam.
- 1 credit for CS 695 (the Ph.D. seminar)

Notice that no credits will be given to accelerated courses (700-level courses). No credits are given to courses in which the student earns a grade of C or below. The student may have to take some other courses as required by the advisor. The credit hours of 500-level coursework must include five core courses with at least one each from Groups I, II, and III described before and at least two courses from two different groups from among Groups IV, V, and VI. Advanced courses may be substituted after approval of the department.

Ph.D. Qualifying Examination

The Ph.D. Qualifying Examination has two parts: a written examination and an oral examination. The written exam is used to judge a student's breadth of knowledge; the oral exam is used to judge a student's research potential. The first attempt at the oral examination and the written examination must be made no later than a student's 3rd semester. The second attempt must be made no later than a student's 4th semester. These requirements hold for both full-time and part-time students.

The written examination is divided into three, independent area examinations. To pass the written examination, a student must pass all the area examinations. Extra coursework cannot be used in lieu of passing an area examination. Area examinations can be taken in the same or different semesters. A student who fails an area examination can retake the area examination, but only once. See the computer science web page for more details about the qualifying examinations.

Comprehensive (Research Proposal) Examination

The purpose of the Comprehensive Examination is to ensure that the candidate has the background to carry out successful research in the chosen area and that the research problem is properly formulated and has sufficient scholarly merit. The student (in concert with the student's research advisor) must develop a written research proposal containing a literature review, a proposed research topic, and a program of research based upon this topic, and then present it orally as well.

The student must request appointment of an examination committee on Form 301. The examination committee may consist of from four to seven members. It must include at least three full-time faculty members from the Computer Science Department and one full-time faculty member from another department in the university. Other committee members from inside or outside the university may be chosen. The student should consult with his/her research advisor concerning the makeup of the committee.

Thesis Defense

Each student must present an oral defense of his/her Ph.D. Thesis. The Thesis Review Committee is appointed in much the same way as the Ph.D. Comprehensive Examination Committee. It will examine the written thesis and examine the student during the oral defense. All Ph.D. Thesis Defenses are open to the public.

Certificate Programs

Certificate programs offer working professionals an opportunity to increase their knowledge and skills in the specific areas of computer science. A certificate representing proven academic performance is presented after the required coursework is completed with a GPA of 3.0/4.0. Courses taken may be later applied toward an M.S. degree program. Applicants should have a bachelors degree from an accredited college or university. The degree need not be in computer science.

Computer Networking and Telecommunications

The student in this program must complete nine hours of coursework from the following:

CS 455 Data Communications
CS 542 Computer Networks I: Fundamentals
CS 544 Computer Networks II: Network Services
CS 548 Broadband Networks

Information Systems

The student in this program must complete nine hours of coursework from the following:

CS 425 Database Organization
CS 521 Object-Oriented Analysis and Design
CS 525 Advanced Database Organization

Software Engineering

The student in this program must complete nine hours of coursework from the following:

CS 445 Object-Oriented Design and Programming
CS 487 Software Engineering
CS 537 Software Metrics
CS 586 Software Systems Architecture
CS 587 Software Project Management
CS 588 Advanced Software Engineering Development
CS 589 Software Testing and Analysis
CS 750 Computer-Aided Software Engineering
CS 763 Automated Software Testing

Accelerated Programs

The department offers accelerated courses for credit in several areas of computer science. These courses go beyond traditional core topics and are designed for working professionals who are interested in keeping abreast of rapidly changing technologies. Accelerated courses provide an opportunity for degree-seeking students at IIT to complete M.S. degree requirements in a shorter time period. If taken by non-degree students, these courses can be applied towards requirements for an M.S. degree at IIT.

Course Descriptions

CS 511
Topics in Computer Graphics
Covers advanced topics in computer graphics. The exact course contents may change based on recent advances in the area and the instructor teaching it. Possible topics include: Geometric modeling, Subdivision surfaces, Procedural modeling, Warping and morphing, Model reconstruction, Image based rendering, Lighting and appearance, Texturing, Natural phenomena, Nonphotorealistic rendering Particle systems, Character animation, Physically based modeling and animation. Prerequisite: CS 411.
(3-0-3)

CS 512
Computer Vision
Introduction to fundamental topics in computer vision and the application of statistical estimation techniques to this area. Intended to give the student a good basis for work in this important field. Topics include: Feature extraction, Probabilistic modeling, Camera calibration, Epipolar geometry, Statistical estimation, Model reconstruction, Statistical filtering, Motion estimation, Recognition, Shape from single image cues. Prerequisite: CS 430.
(3-0-3)

CS 520
Database Design and Engineering
Overview of database architectures, including the Relational, Hierarchical, Network and Object Models. Database normalization and design. Implementation issues for database management systems, including the processing and parsing of SQL queries, query optimization, integrity, and concurrency control. Distributed and parallel databases and data warehouse issues are addressed. Solid programming skills are required. Implementation of a database management engine prototype is required. No credit is given for both this course and CS 425. Prerequisite: CS 351 or CS 402 and CS 430.
(3-0-3)

CS 521
Object Oriented Analysis
This course describes a methodology that covers a wide range of techniques used in system analysis, modeling and design. These techniques integrate well with software process management techniques and provide a framework for software engineers to collaborate in the design and development process. The methodology features the integration of concepts, including software reusability, frameworks, design patterns, software architecture, software component design, use-case analysis, event-flow analysis, event-message analysis, behavioral-life cycle analysis, feature, multiple-product, risk and rule analysis, and automatic code generation. Prerequisite: CS 445.
(3-0-3)

CS 522
Data Mining
Continued exploration of data mining algorithms. More sophisticated algorithms such as support vector machines will be studied in detail. Students will continuously study new contributions to the field. A large project will be required that encourages students to push the limits of existing data mining techniques. Prerequisite: CS 422.
(3-0-3)

CS 525
Advanced Database Organization
Comprehensive coverage of the problems involved in database system implementation and an in-depth examination of contemporary structures and techniques used in modern database management systems. Teaches advanced skills appropriate for DBMS architects and developers, database specialists, and the designers and developers of client/server and distributed systems. Focus is on transaction management, database structures and distributed processing. Prerequisite: CS 425.
(3-0-3)

CS 529
Information Retrieval
Continued exploration of information retrieval algorithms. Topics will include: Text classification, metasearch, mediators, semi-structured information retrieval, name search, etc. Students will continuously study new contributions to the field. A large project will be required that encourages students to push the limits of existing information retrieval. Prerequisites: CS 429.
(3-0-3)

CS 530
Theory of Computation
Computability topics such as Turing machines, nondeterministic machines, undecidability results, and reducibility. Computational Complexity topics such as time complexity, NP-Completeness and intractability, time and space hierarchy theorems. Introduces the complexity classes P, NP, NL, L, PSPACE, NC, RNC, BPP and their complete problems. Prerequisites: CS 430.
(3-0-3)

CS 531
Topics in Automata Theory
Topics selected from mathematical systems and automata theory, decision problems, realization and minimization, algebraic decomposition theory and machines in a category. Prerequisite: CS 430.
(3-0-3)

CS 532
Formal Languages
Topics selected from mathematical systems and automata theory, decision problems, realization and minimization, algebraic decomposition theory and machines in a category. Prerequisite: CS 430.
(3-0-3)

CS 533
Computaional Geometry
The course covers fundamental algorithms and data structures for Convex Hulls, Voronoi Diagrams, Delauney Triangulation, Euclidean Spanning Trees, Point Location, Range Searching. Also included are lower bounds and discrepancy theory. Optimization in geometry will be covered. This includes fixed dimensional linear programming and shortest paths. Graphic data structures such as BSP trees will be covered. Prerequisites: CS 430 and a linear algebra course.
(3-0-3)

CS 535
Design and Analysis of Algorithms
Design of efficient algorithms for a variety of problems, with mathematical proof of correctness and analysis of time and space requirements. Topics include lower bounds for sorting and medians, amortized analysis of advanced data structures, graph algorithms (strongly connected components, shortest paths, minimum spanning trees, maximum flows and bipartite matching), and NP-Completeness. Prerequisites: CS 430.
(3-0-3)

CS 536
Science of Programming
Formal specification of how programs execute operational semantics, how mathematical functions programs compute (denotational semantics) and how to use logic to characterize properties and invariants of the program execution (axiomatic semantics). Prerequisite CS 331 or CS 401.
(3-0-3)

CS 537
Software Metrics
Theoretical foundations for software metrics. Data collection. Experimental design and analysis. Software metric validation. Measuring the software development and maintenance process. Measuring software systems. Support for metrics. Statistical tools. Setting up a measurement program. Application of software measurement. Prerequisite: CS 487.
(3-0-3)

CS 538
Combinatorial Optimization
Linear programs and their properties. Efficient algorithms for linear programming. Network flows, minimum cost flows, maximum matchings, weighted matchings, and matroids. Prerequisite: CS 430 and a linear algebra course.
(3-0-3)

CS 540
Foundations Of Programming Language Design
The basic motivations and philosophy underlying the applications of semantic techniques in programming language theory. The structures used in semantics and the techniques that have been developed for relating various approaches to the semantics of programming languages. Prerequisite: CS 440.
(3-0-3)

CS 541
Topics in Compiler Construction
Advanced topics in compiler construction, including incremental and interactive compiling, error correction, code optimization and models of code generation. The objective of the course is to provide an in-depth coverage of compiler optimization techniques, including both classical optimizations and areas of current interest in compiler research. Prerequisite: CS 440.
(3-0-3)

CS 542
Computer Networks I : Fundamentals
This course focuses on the engineering and analysis of network protocols and architecture in terms of the Internet. Topics include content distribution, peer-to-peer networking, congestion control, unicast and multicast routing, router design, mobility, multimedia networking, quality of service, security and policy- based networking. Prerequisite: CS 455.
(3-0-3)

CS 544
Computer Networks II : Network Services
Qualitative and quantitative analysis of networks. A combination of analytical and experimental analysis techniques will be used to study topics such as protocol delay, end-to-end network response time, intranet models, Internet traffic models, web services availability, and network management. Prerequisites: CS 542 or ECE 545.
(3-0-3)

CS 545
Distributed Computing Landscae
Introduction to the theory of concurrent programming languages. Topics include formal methods of concurrent computation as process algebra, nets and actors, high-level concurrent programming languages and their operational semantics, methods for reasoning about correctness and the complexity of concurrent programs. Prerequisite: CS 450.
(3-0-3)

CS 546
Parallel and Distributed Processing
General issues of parallel and distributed processing including systems, programming, performance evaluation and application of parallel and distributed computers. The influence of communication and parallelism on algorithm design. Prerequisites: CS 430, CS 450.
(3-0-3)

CS 547
Wireless Networking
This course introduces cellular/PCS systems, short-range mobile wireless systems, fixed wireless systems, satellites, and ad hoc wireless systems. It explains in detail the underlying technology as well regulations, politics, and business of these wireless communications systems. It looks beyond the hype, examining just what is and is not possible with present-day and future wireless systems. As an advanced graduate course, it will combine extensive reading and in-class discussion of the research literature with in-depth independent research projects of the students own choosing. Prerequisite: CS 455.
(3-0-3)

CS 548
Broadband Networks
The course studies the architectures, interfaces, protocols, technologies, products and services for broadband (high-speed) multimedia networks. The key principles of the protocols and technologies used for representative network elements and types of broadband network are studied. Specifically, cable modems, Digital Subscriber Lines, Power Lines, wireless 802.16 (WiMax), and broadband cellular Internet are covered for broadband access; for broadband Local Area Networks (LANs), Gigabit Ethernet, Virtual LANs, and wireless LANs (802.11 WiFi and Bluetooth) are discussed; for broadband Wide Area Networks (WANs), the topics covered include optical networks (SONET/SDH, DWDM, optical network nodes, optical switching technologies), frame-relay, ATM, wire-speed routers, IP switching, and MPLS. Also, quality of service issues in broadband networks and a view of the convergence of technologies in broadband networks are covered. Prerequisite: CS 455.
(3-0-3)

CS 549
Cryptography and Network Security
This course provides an introduction to the theory and the practice of cryptography and network security. The course covers conventional encryption such as classical encryption techniques, modern encryption techniques, and encryption algorithms. Students are introduced to the basic number theory, which is used as the foundation for public-key encryption. The public-key cryptography such as encryption methods and digital signatures is covered. Message authentication and hash functions are also discussed. Students will learn techniques of key management, secret sharing and conducting interactive proofs. In addition, the practical network and security protocols are discussed. Prerequisite: CS 430.
(3-0-3)

CS 550
Advanced Operating Systems
Advanced operating system design concepts, such as multimedia OS, multiprocessor systems, virtual memory management, process migration, process scheduling, synchronization, file systems. Study of systems highlighting these concepts. Prerequisite: CS 450.
(3-0-3)

CS 551
Operating System Design and Implementation
This course covers in detail the design and implementation of processes, interprocess communication, semaphores, monitors, message passing, remote procedure calls, scheduling algorithm, input/output, device drivers, memory management, file system design, network file servers, atomic transactions, security and protection mechanisms. The hardware-software interface is examined in detail. Students modify and extend a multi-user operating system. Prerequisites: CS 450.
(3-0-3)

CS 552
Distributed Systems
Advanced distributed system design concepts, such as distributed processes and memory management, distributed file systems, consistency and fault tolerance, security and transaction system structures, and distributed programming. Programming in representative distributed environments. Prerequisite: CS 450.
(3-0-3)

CS 553
Pervasive Computing
Concepts in computing that create an ubiquitous environment, combining processors and sensors with network technologies (wireless and otherwise) and intelligent software. Issues of middleware and middleware development, including mobility, context awareness, resource discovery, cyberforaging, agents, QOS, P2P, web services as well as other pervasive and ubiquitous technologies. Prerequisites: CS 450 or CS 455 and 470.
(3-0-3)

CS 555
Analytic Models and Computer Simulation
Analytic and simulation techniques for the performance analysis of computer architecture, operating systems and subsystems. Rigorous development of queuing models. Study of simulation languages and models. Prerequisites: CS 450.
(3-0-3)

CS 560
Computer Science in the Classroom
Preparation and formulation of computer science courses. Detailed weekly materials organized and perfected. The goal being to develop Open Course Ware (OCW).
(1-4-3)

CS 561
The Computer and Curriculum Content
Emphasis on the presentation concepts. Selecting the best mode of delivery and using the power of the web page to enhance the presentation.
(1-4-3)

CS 565
Computer Assisted Instruction
Hardware and software for the effective use of the computer in an educational environment, CAI (Computer-Assisted/Aided Instruction) being one of the major areas of investigation. Prerequisite: CS 560 or CS 561.
(3-0-3)

CS 566
Practicum in the Application of Computers to Education
Provides supervised experience in the development of computer-based teaching units. Evaluation of different theoretical and/or technical approaches to use of computer in the classroom. Prerequisite: CS 560 or CS 561.
(1-4-3)

CS 570
Advanced Computer Architecture
Advanced computer system design and architecture, such as pipelining and instruction-level parallelism, memory-hierarchy system, interconnection networks, multiprocessors, and clusters of servers. Selected study on current experimental computer systems. Prerequisite: CS 450 and CS 470.
(3-0-3)

CS 572
Advanced Topics in Computer Architecture
Current problems in computer architecture. Prerequisite: CS 570.
(3-0-3)

CS 580
Medical Informatics
This course provides an introduction to computer applications in health care with an emphasis on the contributions of artificial intelligence and database analysis. Topics will include medical expert systems, medical decision analysis, reasoning under uncertainty, medical tutoring systems, medical language processing, medical record systems, hospital and office information systems, laboratory, pharmacy, radiology and bibliographic information retrieval systems. Presentations and papers or projects will be required. Prerequisites: CS 425, CS 480.
(3-0-3)

CS 581
Topics in Artificial Intelligence
Covers various advanced topics in AI, including both theory and practice. Content may vary by instructor. Possible topics include: Planning: STRIPs planning; Partial-order planning; Situation calculus; Theorem proving; GraphPlan/SatPlan; Transformational planning; Simulated annealing; Motion planning; Case-based reasoning; Multi-agent coordination; Negotiation planning; Representation and Reasoning: Logical representation; Frame problem; Probabilistic reasoning; Bayesian networks; Game Playing: Minimax search; Evaluation functions; Learning evaluation functions; Markov Decision Processes; Reinforcement learning for games; Developing AI agents; Multi-agent planning. Prerequisite: CS 480.
(3-0-3)

CS 582
Computational Robotics
Covers basic algorithms and techniques used in Computational Robotics, to give the student a good basis for work in this highly relevant field. Topics include: Locomotion, Non-visual sensors and algorithms, Uncertainty modeling, data fusion, State space models, Kalman filtering, Visual sensors, Sampling theory, Image features, Depth reconstruction, Multiple view geometry, Ego-motion, Active vision, Reasoning, Spatial decomposition, Geometric representations, Topological representations, Path planning, Spatial uncertainty, Active control, Pose maintenance, Dead reckoning, Correlation-based localization, Sensorial maps, Task planning and task interference, Multi-agent coordination. Prerequisite: CS 430.
(3-0-3)

CS 583
Expert Systems
Medical expert systems and clinical decision analysis. Decision making under uncertainty. Inference mechanisms for expert systems: production rules, pattern recognition, automatic theorem proving, fuzzy logic. Expert system architecture. Knowledge engineering. Information retrieval. Natural language interfaces. Prerequisite: CS 480.
(3-0-3)

CS 584
Machine Learning
Covers basic algorithms and techniques used in Machine Learning, to give the student a good basis for work in this highly relevant field. Topics include: Version space learning, Computational learning theory, PAC-learning, VC-dimension, Online learning, Winnow, Perceptrons, Neural Networks, Backpropagation, Genetic algorithms, Bayesian learning, Experimental design, Decision-tree learning, Covering algorithms for learning rule sets, Minimum description length, Clustering algorithms, Reinforcement learning, Markov decision processes. Prerequisite: CS 480.
(3-0-3)

CS 585
Natural Language Processing
An introduction to the problems of computing with human languages. Parsing. Semantic representations. Text generation. Lexicography. Discourse. Sublanguage studies. Applications to CAI, database interfaces and information retrieval. Prerequisite: CS 445.
(3-0-3)

CS 586
Software Systems Architecture
This course covers the state-of-theart in architectural design of complex software systems. The course considers commonly used software system architectures, techniques for designing and implementing these architectures, models and notations for characterizing and reasoning about architectures, and case studies of actual software system architectures. Prerequisite: CS 487.
(3-0-3)

CS 587
Software Project Management
Concepts of software product and process quality. Role of TQM in software project management. Use of metrics, feasibility studies, cost and effort estimates. Discussion of project planning and scheduling. The project team and leadership issues. The Capability Maturity Model: basic tenets and application of process evaluation. Prerequisite: CS 487.
(3-0-3)

CS 588
Advanced Software Engineering Development
Software development process improvement is a major objective of this course. This is achieved through a series of individual programming and process projects. Students learn to plan their projects, apply measurements, estimate size, schedule tasks, and classify defects in order to improve the quality of both their development process and their software products. Prerequisite: CS 487.
(3-0-3)

CS 589
Software Testing and Analysis
Concepts and techniques for testing and analysis of software. Software testing at the unit, subsystem, and system levels. Specification-based testing. Code-based testing. Modelbased testing. Methods for test generation and validation. Static and dynamic analysis. Formal methods and verification. Reliability analysis. Prerequisite: CS 487.
(3-0-3)

CS 590
Seminar in Computer Science
Investigation and discussion by faculty and students concentrated on some topic of current interest. May be taken more than once. Prerequisite: Written consent of instructor.
(3-0-3)

CS 591
Research and Thesis for M.S. Degre
(Credit: Variable)

CS 595
Topics in Computer Science
This course will treat a specific topic, varying from semester to semester, in which there is particular student or staff interest. May be taken more than once. Prerequisite: Written consent of instructor.
(Credit: Variable)

CS 597
Reading and Special Problems
Prerequisite: Written consent of instructor. May be taken more than once.
(Credit: Variable)

CS 612
Topics in Computer Vision
Cover advanced topics in computer vision to enhance the knowledge of students interested in this highly important area. The topics in this course may change between semesters depending on the instructor teaching the course and the current state of the art in this area. Possible topics include: Image based modeling and rendering, Multiple view geometry, Auto-calibration, Object recognition, Motion analysis, Tracking, Perceptual user interfaces, Face and gesture recognition, Active vision. Prerequisite: CS 512.
(3-0-3)

CS 630
Advanced Topics in Algorithms
Theoretical analysis of various types of algorithms. Topics vary, and may include quantum, approximation, online, distributed, randomized, and parallel algorithms. Prerequisite: CS 430 and consent of instructor.
(3-0-3)

CS 642
Advanced Topics in Networking
Introduction to advanced networking research. A particular focus area will be considered, keeping current with advances in computer networking. Quantitative methods will be emphasized. Prerequisite: CS 542.
(3-0-3)

CS 681
Topics in Combinatorial Linguistics
Covers various topics in linguistics as they may be applied to various computational problems in AI, NLP, or IR. The topics in this course may change between semesters depending on the instructor teaching the course and the current state of the art in this area. Possible topics include: Systemic Functional Linguistics, Clausal structure, Group structure, Complex structure, Cognitive Linguistics, Process semantics. Prerequisite: CS 585.
(3-0-3)

CS 689
Advanced Topics in Software Engineering
Course content is variable and reflects the current trends in software engineering. Prerequisite: Consent of instructor.
(3-0-3)

CS 691
Research and Thesis for PhD Degree
(Credit: Variable)

CS 695
Doctoral Seminar
(1-0-1)

Courses available for Master of Computer Science Program

CSP 527
Client-Server Application Development
Through hands-on experience in developing a client-server database project and developing and managing a client-server Internet project, this course teaches advanced skills for effective design and implementation of client-server applications. Students will examine the architectural and functionality decisions, technologies, configurations, languages, and techniques associated with client-server systems. Active/passive client-server technologies, as well as public, enterprise-wide, and inter-enterprise approaches to decision and operation support are discussed and implemented. Prerequisite: CS 425.
(3-0-3)

CSP 541
Internet Technologies
This course focuses on the technologies and protocols used by Internet WANs and LANs. The fundamental architecture, organization, and routing principles of the Internet are described. Part of the course will focus on emerging Internet technologies. Prerequisite: CS 455.
(3-0-3)

CSP 542
Internet Design and Analysiss
This course examines the principles of network design. The design process is studied from requirements gathering to deployment. The student will gain experience in estimating application load, network sizing, component choice, and protocol choice. Internetworking between popular components and protocols will be studied. Analytical and simulation techniques are described and used to design several local- and wide-area networks. Prerequisite: CS 455.
(3-0-3)

CSP 543
Multimedia Networking
This course covers the architectures, protocols, and design issues for multimedia networks. Topics covered include coding, compression, streaming, synchronization, QoS, and adaptation. Current tools for multimedia networking will be surveyed. Issues with multimedia application development will be explored. Students will design and develop multimedia applications. Prerequisites: CS 455 and experience programming in high-level languages.
(3-0-3)

CSP 544
System and Network Security
This course will present an in-depth examination of topics in data and network security, such as: Access control, authentication, security assessment, network and data security tools, and security policies. A significant hands-on component includes network incidents to detect and fix. Prerequisites: CS 430, CS 455.
(3-0-3)

CSP 545
Wireless Networking Technologies and Applications
This course will present the foundation of wireless technologies and examine state-of-the-art wireless systems, services, network technologies, and security. Prerequisites: CS 542.
(3-0-3)

CSP 550
Internet Programming
This course discusses current fundamental concepts and development techniques for distributed applications. Topics covered include multithreaded programs, sockets, message-passing systems, remote method invocation and procedure calls, peer-to-peer networks, and underlying technologies for internet applications. Prerequisite: CS 455.
(3-0-3)

CSP 551
Advanced UNIX Programming
This course provides students a hands-on introduction to UNIX programming topics such as standard application programmer interfaces, concurrent programming, UNIX processes and threads, shell programming, UNIX interprocess communications, client-server designs, and application portability. Prerequisites: C programming, CS 450 or equivalent, and user-level knowledge of UNIX.
(3-0-3)

CSP 581
Applied AI Programming
To learn AI programming algorithms and techniques in Common Lisp. Time is split between Common Lisp topics and discussions of implementation strategies for AI algorithms. Prerequisite: CS 440 or equivalent.
(3-0-3)

CSP 585
Object Oriented Design Patterns
This course introduces the principles of design patterns for Object- Oriented software systems. A catalog of design patterns is shown, to illustrate the roles of patterns in designing and contracting complex software systems. The catalog of design patterns also provides a pragmatic reference to a well-engineered set of existing patterns currently in use. Also discussed is the impact of post-object-oriented software development on design patterns. Prerequisite: CS 445.
(3-0-3)

CSP 586
Software Modeling and Development with UML
Students will obtain a significant exposure to the UML technology. This will include exposure to modeling, model-driven development, executable models, and round-trip engineering. These technologies will be explained at the application level. Prerequisite: CS 487 or CS 445.
(3-0-3)

CSP 587
Software Quality Management
Students will learn methods of software quality management. This will include exposure to software quality assurance, quality measures, and quality control. These quality management methods will be explained at the applications level. Prerequisite: CS 487 or equivalent.
(3-0-3)

CSP 595
Topics in CSP

Fundamental Prerequisite Courses in Compuiter Science

Students whose background in computer science is deficient are required to take the following courses and earn a grade B or better. The credits for these courses may not be used for any degree program in computer science, computer information systems or computer engineering.

CS 401
Introduction to Advanced Studies I
First course in a two-course sequence that is designed to prepare students for graduate study in computer science. The course covers advanced programming concepts including pointers, recursion and inheritance, as well as data structures and algorithms including linked lists, stacks, queues, heaps, graphs, and sorting techniques. Prerequisite: CS 201 or equivalent.
(3-0-3)

CS 402
Introduction to Advanced Studies II
Second course in a two-course sequence that is designed to prepare students for graduate study in computer science. The course consists of two parts. The first part introduces the students to computer organization and architecture, numbering systems, logical operations and fundamentals of assembly language programming. The second part of the course is devoted to event driven programming concepts using Java as the programming tool. Multithreading programming concepts are also covered using Java. Prerequisite: CS 401 or consent of instructor.
(3-0-3)

Undergraduate Courses Available for Graduate Students

CS 411
Computer Graphics

CS 422
Introduction to Data Mining

CS 425
Database Organization

CS 429
Introduction to Information Retrieval

CS 430
Introduction to Algorithms

CS 440
Programming Languages and Translators

CS 441
Current Topics in Programming Languages

CS 445
Object-Oriented Design and Programming

CS 447
Distributed Objects

CS 450
Introduction to Operating Systems

CS 455
Data Communications

CS 458
Information Security

CS 470
Computer Architecture I

CS 471
Design of Computer Processors

CS 480
Artificial Intelligence

CS 485
Computers and Society

CS 487
Software Engineering

Institute of Design

350 N. LaSalle St.
Chicago, IL 60610
312.595.4900 main
312.595.4906 graduate study information
312.595.4901 fax
design@id.iit.edu
www.id.iit.edu

Dean:
Patrick F. Whitney

The Institute of Design (ID) is defined by a legacy of experimentation joined with unique academic programs and a systematic, analytical approach to design and problem solving. It has embraced new technology and experimentation since its founding by Laszlo Moholy-Nagy in 1937 as New Bauhaus. In 1944, the school was renamed the Institute of Design, and, in 1949, it merged with Illinois Institute of Technology.

IDs program is markedly different from other graduate design programs because of its insistence on usercenteredness, its development of rigorous, verifiable methods, and its emphasis on placing design at the center of the development process.

Today, the school has the nations largest full-time, graduate program in design and offers a Ph.D. in design research. Students in the professional masters (M.Des.) program may specialize in any number of areas, from observing and understanding users in specific contexts, analyzing complex information, developing and exploring alternative solutions, and prototyping future innovations and scenarios. Examples of individual courses of study include communication design, interaction, product design, strategic planning, user research, design methods research, and systems design. Students in the advanced Master of Design Methods (M.D.M.) program enroll in core and specialty courses and selected workshops focusing exclusively on advanced design methods.

IDs development of separate research and professional degrees addresses the new commitment of the field to the importance of design research, while recognizing the increasing demand for professional education at the mastery level. IDs research community is as unique as its curriculum. Faculty members are active contributors to the design field. The 12 full-time faculty and approximately 20 adjunct members represent specific areas of expertise critical to design, such as product design, communication design, information design, design planning, the history of design, interactive diagrams, cognitive psychology, anthropology, semantics of form, imaging, and computer science. Students draw upon these many perspectives to observe and analyze realworld environments as a means of designing information, visualizations, products and services that shape and are shaped by how people live.

Graduate students typically come to ID from all over the world, often after years spent in their professions. In addition to professional designers who enter the school, ID accepts and encourages students with backgrounds outside of design. The student body draws from backgrounds as diverse as chemistry, engineering, the fine arts, computer science, architecture, anthropology and psychology.

Degrees Offered

Master of Design (M.Des.)
Master of Design Methods (M.D.M.)
Master of Design (M.Des.)/M.B.A. dual degree
Doctor of Philosophy (Ph.D.)

Research Facilities

Research is supported by a networked computing system that enables students to digitize and manipulate photographic images, analyze problems, model forms, create interactive multimedia and individualized publications, and develop new systems and tools. Equipment includes Silicon Graphics, Sun, Dell, and Apple computers and a wide variety of peripherals.

Research Areas

ID provides an unmatched community of faculty and students who are conducting essential design research. Interests are broad, but tend to focus on users interactions with their environment, methods of innovation within organizations, and the value of design for business and strategy. Doctoral students conduct research regarding the fundamental methods and principles of human-centered design and design planning in both symbolic and real dimensions.

Faculty

Jeremy Alexis, Assistant Professor. B.Arch, M.Des., Illinois Institute of Technology.

Judith Gregory, Assistant Professor. B.A., Antioch College. Ph.D., University of California-San Diego.

Dale Fahnstrom, Professor. B.F.S., M.F.A., University of Illinois, Urbana-Champaign.

John Grimes, Professor. B.A., University of Illinois. M.S., Illinois Institute of Technology.

Vijay Kumar, Professor. B.S., National Institute of Design (India); M.S., Illinois Institute of Technology.

Anijo Mathew, Assistant Professor. B.Arch., Birla Institute of Technology (India); M.Des. Harvard University.

Charles Owen, Distinguished Professor Emeritus. B.S., Purdue University; M.S., Illinois Institute of Technology.

Keiichi Sato, Professor. B.S., M.S, Osaka Institute of Technology; M.S., Illinois Institute of Technology.

Patrick F. Whitney, Professor and Director. B.F.A., University of Alberta; M.F.A., Cranbrook Academy of Art.

Admission Requirements

Cumulative undergraduate GPA minimum: 3.0/4.0
Minimum GRE score: 1000 (verbal & quantitative), 3.5 (analytical writing)
TOEFL minimum: 550
TSE (Test for Spoken English) minimum: 24

Admission to ID is highly competitive. Meeting the minimum GPA and test score requirements does not guarantee admission. Test scores and GPAare just two of several important factors considered. For admission to the master of design (M.Des.) program, an applicant must hold a baccalaureate degree from an accredited educational institution with a minimum cumulative GPA of 3.0/4.0, must have a strong record of academic achievement, and must be highly recommended. All applicants without an undergraduate degree in design must submit GRE scores. Applicants from countries whose native language is not English must submit scores for TOEFL and TSE. The TOEFL and TSE requirements are waived for applicants with a degree from universities in Englishspeaking countries.

Portfolios are required for applicants who possess design degrees. Regardless of previous degrees, students may be required to complete prerequisite design courses before starting their M.Des. requirements. Applicants without design degrees are encouraged to apply to the M.Des. Program. Such applicants must complete a series of specified prerequisite design courses before starting the M.Des. degree requirements.

Applicants to the M.D.M. program must hold a four-year bachelors degree from an accredited university, possess outstanding visual skills as demonstrated in a professional portfolio or an exemplary portfolio of non-design innovation projects, and have a minimum of 5 years of management and leadersip experience in design or innovation and a demonstrated record of excellence in the field (as in awards from IDSA, AIGA, or other associations). Applicants must also submit three letters of recommendation from professional contacts, and have a successful interview with an Institute of Design faculty member.
Applicants to the Ph.D. program must hold a master's degree in design from an accredited educational institution, have a distinguished record of academic achievement and be very highly recommended. Applicants without a masters degree should apply for the M.Des. program.

Doctoral applicants with a masters degree in design must show evidence of distinguished academic and, if appropriate, professional work in their fields. Applicants with design degrees or degrees from programs in related fields with studio courses must present a portfolio and may be required to complete some design courses as deficiency studies. All Ph.D. applicants must have completed college level courses in mathematics (calculus and statistics) and programming (Fortran, Pascal, or C++). Depending on the applicant's academic background and intended area of study, other prerequisite courses also may be required. Admitted applicants who have not completed these courses must take them immediately.

Master of Design

54 credit hours

The Master of Design (M.Des.) program is a two-year, 54- credit-hour degree program intended for those seeking professional mastery at the highest level in the field of communication or product design or design planning. The degree terminates with a project demonstrating the application of new theories and processes to contemporary and developing design problems in a variety of areas.

The program does not require the formal selection of a concentration area or track. Students may construct their own curriculum after taking a core of methods courses focused on observing and understanding users in specific contexts, analyxing complex information, developing and exploring alternative solutions, and prototyping future innovations and scenarios. Examples of individual courses of study include communication design, interaction, product design, strategic planning, user research, design methods research, and systems design.

Residence

The M.Des. Program requires continuous full-time study at the Institute of Design for a minimum of four semesters. Students must enroll in at least 13.5 credit hours of course work each semester.

Curriculum

54 credit hours

Required Courses

6.5 credit hours

ID 514 Design Planning
ID 516 Observing Users
ID 533 Design Analysis
ID 559 Physical Human Factors

Elective courses

47.5 Credit Hours
Students select a series of courses from the available workshops and seminars to meet the objectives of the student's professional goals. Choices will be made in consultation with the student's advisor and will count for at least 41 hours of the required program.

ID 428 Adv. Architectural Photo
ID 481 Graduate Intro to Design 1
ID 482 Graduate Intro to Design 2
ID 483 Graduate Intro to Comm Design 1
ID 484 Graduate Intro to Comm Design 2
ID 485 Graduate Intro to Product Design 1
ID 486 Graduate Intro to Product Design 2
ID 487 Graduate Intro To Photography
ID 488 Graduate Intro To Digital Media
ID 510 Principles and Methods of Research
ID 511 Philosophical Context of Design Research
ID 515 Design Policy
ID 517 Design Languages
ID 518 Business Frameworks
ID 519 Economics and Design
ID 520 Communication Planning
ID 521 Product Planning
ID 522 Technological Development and Design Innovation
ID 524 Strategic Design Planning
ID 525 Design Planning and Technological Innovation
ID 526 Design Planning and Market Forces
ID 528 Advanced Design Planning
ID 529 Structured Planning
ID 530 Information Structuring
ID 531 Computer Apps in Design
ID 534 Design Synthesis
ID 535 Decision Making
ID 536 Concept Evaluation
ID 538 Service Design
ID 540 Advanced Communication Design
ID 541 Advanced Product Development
ID 542 Interaction for Products
ID 543 New Product Definition
ID 544 Interface Design
ID 545 Interactive Media
ID 546 Diagram Development
ID 547 Product Architecture and Platform
ID 548 Life Cycle Design
ID 554 Visual Language
ID 555 Metaphor and Analogy in Design
ID 556 Meaning and Form
ID 557 Dynamic Diagrams
ID 558 Theories of Information and Communication
ID 559 Physical Human Factors
ID 567 Economics of Product Development
ID 568 Research Methods for Product Development
ID 569 Intellectual Property and Product Development
ID 572 Systems and Systems Theory in Design
ID 573 Design Planning: Opportunity Identification
ID 574 Design Planning: Developing Options
ID 577 Product Form
ID 578 Design Planning Implementation
ID 579 Production Methods
ID 580 Design Workshop
ID 581 Photo Workshop
ID 582 Comm Design Workshop
ID 583 Prod Design Workshop
ID 584 Design Planning Workshop
ID 588 Interactive Media Workshop
ID 589 Systems Workshop
ID 592 Research and Demo
ID 598 Special Topics
ID 685 Dissertation Seminar
ID 691 Research and Thesis for Ph.D.

Master of Design Methods

30 credit hours

The Master of Design Methods (MDM) is a nine month (or 2-3 year part-time) executive master's degree for exceptional design, management, engineering and other professionals who wish to acquire robust design methods and frameworks and to apply design thinking to the development of products, communications, services, and systems. MDM courses cover design methods and frameworks in areas like user observation and research; prototyping of new services, products and businesses; creating systems of innovation; visualizing alternative futures; and linking user innovation to organizational strategy.

Residence

The M.D.M. can be taken in two semesters full-time, four semesters half time, or six semesters at one-third time.

Curriculum

30 hours

Required Courses

6.5 hours

ID 514 Design Planning
ID 516 Observing Users
ID 533 Design Analysis
ID 559 Physical Human Factors

Elective courses

23.5 hours

Students select a series of courses from the available workshops and seminars to meet the objectives of the student's professional goals. Choices will be made in consultation with the student's advisor and will count for at least 23.5 hours of the required program.

Students select from the same pool of elective classes as found under the Master of Design description.

Dual degree programs

M.Des./M.B.A.

44 Institute of Design Credits
36 Stuart School of Business Credits

Required courses:

6.5 Credit Hours from Institute of Design

ID 514 Design Planning
ID 516 Observing Users
ID 533 Design Analysis
ID 559 Physical Human Factors

30 Credit Hours from Stuart School of Business

MBA 501 Financial and Management Accounting
MBA 503 Organizational Behavior
MBA 505 Managerial Economics
MBA 507 Managerial Decision Making
MBA 509 Managerial Finance
MBA 511 Marketing Management
MBA 513 Operations and Technology Management
MBA 515 Strategic Information Systems
MBA 517 Strategic Competitiveness
MBA 519 Business Tactics: Integrated Functional Management
MBA 520 Strategic Management

Elective courses

37.5 hours Institute of Design
6 hours Stuart School of Business

The program director or academic advisor will develop a curriculum plan when the student begins the dual-degree program. Typically, students will save because M.B.A. will double count 6 M.Des. credits towards general electives and 6 credits towards the Design Leadership concentration, and M.Des. will double count 6 M.B.A. credits towards electives. The program director may make exceptions to this plan depending upon the student's individual situation.

Doctor of Philosophy

107 credit hours
Language examination
Comprehensive examination
Dissertation

The Ph.D. in design is a research program for those who wish to teach or conduct research in design. The program culminates with a dissertation that extends the body of knowledge about design theory and process. With the approval of their advisers, students may elect to study within the design planning or human-centered design tracks, or they may develop a different area of study that is important to the evolution of new knowledge in design theory or process.

Candidacy

Early in their studies, admitted doctoral students will be required to submit and obtain approval for a program of study and pass a foreign language requirement. Within two years of being admitted, and after approval of the program of study and passage of the foreign language examination, the student must take a comprehensive examination. This examination is intended as a rigorous review of the level of competence achieved by the student as a result of the entire program of graduate study (except for the dissertation) as approved by the advisory committee and specified in the program of study form. Students are not considered candidates for the Ph.D. degree until after the comprehensive examination is passed.

Residence

The Ph.D. program normally requires a minimum of three years of study beyond the master's degree. The first four semesters must be continuous study at the Institute of Design. Students must enroll in at least 15 credit hours of course work for each of the first three semesters.

Language Satisfactory reading knowledge of German, Japanese, French, or Russian must be met before the student applies to take the comprehensive examination.

Curriculum

Totals 107 credit hours

Master's program in design

32 hours or greater

Research Sequence

21 hours

The research sequence is a series of projects and courses selected from available design workshops and specialty courses to meet the objectives of the student's research goals. Choices will be made in consultation with the student's adviser and will account for at least 21 credit hours of the required program beyond the M.S. degree.

Design Workshops

Workshops are major, semester-long project courses that explore design problems in breadth and depth. Processes and information from the specialty courses are developed here in practical and experimental applications. Choices are made in consultation with the student's adviser from ID classes numbered 580-589.

Specialty Courses

Specialty courses are courses in special branches of design theory, process or practice, and are normally selected from half-semester courses, ID 500–559 and ID 568–576.

Seminars

6 hours
Seminars are discussion courses that consider topics of contemporary interest and provide a continuing meeting ground and forum for students during their course and project work.

Electives

12 hours
Electives include full- or half- semester courses selected from the university's course offerings to complement objectives of the student's program. These courses should be at least 400-level and should be selected with adviser approval. Note: Summer research on projects designated by the department may substitute for up to three hours of elective or research sequence credit requirements.

Dissertation

48 hours
A distinct, substantial and original contribution to design knowledge. ID 691 Research and Thesis for the Ph.D.

Course Descriptions

Numbers in parentheses indicate class, lab and credit hours, respectively. Graduate standing in the Institute of Design is a prerequisite for all courses.

ID 428
Advanced Architectural Photography
Offers basic instruction in architectural photography primarily for upper level undergraduate and graduate level architecture students. Covers basic camera operation and exposure, photography of flat art and studio lighting, interior and exterior photography, and the photography of distinguishing features of the urban landscape.
(1-2-2)

ID 481
Design I
The first of two accelerated courses in design history, theory and materials for graduate students who have insufficient undergraduate preparation in this area.
(3-0-3)

ID 482
Graduate Intro to Design
Instills familiarity with the professional practice of design in its main forms, disciplines and applications, including product design, communication design, design planning, design research, interaction design, service design and design education. Covers the skills required, activities, challenges, common tools and leading players in these areas of practice. Also covers design industry employment skills and basic drawing and visualization.
(1-2-2)

ID 483
Graduate Intro to Communication Design I
Provides a sound understanding of two-dimensional form and introduces basic concepts of graphic design, including factors of visual perception and syntax, principles of creating order and meaning, compositional techniques, aesthetic properties of visual form, information processing, and understanding the environmental, cultural and personal context of the viewer. Considerable emphasis is placed on typography.
(1-2-2)

ID 484
Graduate Intro to Communication Design II
Provides fundamentals for planning and editing information and communicating it in print, web, and three-dimensional exhibition form, from concept generation to visualization. Relevant perceptual and cognitive principles are discussed.
(1-2-2)

ID 485
Graduate Intro to Product Design I
Teaches the fundamental principles and processes of product design through simple projects and skill building exercises, and study of more advanced projects and case studies. Skills taught include diagramming, orthographic sketching and rendering, basic three-dimensional model building, and documenting intent for presentation.
(1-2-2)

ID 486
Graduate Intro to Programming Design II
Prepares students to practice basic product design and instills professional understanding of the responsibilities and value of product design to manufacturing organizations and end-users. Key topics include establishing design criteria, design ideation, geometry, structure and assembly, materials and fabrication, drawing, prototyping and solid modeling, and final presentation.
(1-2-2)

ID 487
Graduate Intro to Photography
Acquaints design students with the field of photographic image making, how images are constructed and the ways they are used to communicate. Students learn the fundamental principles of image making, color theory, lighting, and digital image processing through the practice of creating images. All work is performed using digital cameras and software.
(1-2-2)

ID 488
Graduate Intro to Digital Media
Surveys the basic media types used in interactive software. Includes a culminating project that demonstrates basic principles of screen design and computer-human interaction using a variety of media. Projects require use of common software applications for creating and editing six data types: text, bitmap, geometry, sound, animation and video.
(1-2-2)

ID 510
Principles and Methods of Design Research
Introduces the basic principles and methods for assembling, developing and analyzing information in the tasks of design research. Techniques for collecting data, testing hypotheses and presenting conclusions are learned in the context of conducting a pilot research project.
(3-0-1.5)

ID 511
Philosophical Context of Design Research
Explores the philosophical framework for conducting research and building knowledge in the field of design. Topics include concepts from epistemology, phenomenology and structuralism. Comparisons are made between design research and research in other fields.
(3-0-1.5)

ID 514
Design Planning
Introduces students to the context of design planning. It includes a discussion of the general forces acting upon an organizationcompetition, technological developments, channels of information and product distribution and ways to understand the people who use design. Particular attention is paid to how, within the context of all of these forces, design can benefit an organization.
(3-0-1.5)

ID 515
Design Policy
Investigates the formation and intent of design policy by governments across the world. Particular attention is focused on the relationship of organizations implementing these policies to the political and economic structure of different countries and on measures assessing their success.
(3-0-1.5)

ID 516
Oberving Users
Introduces observational and ethnographic methods in design. Ethnographic methods are used in fieldwork to help researchers develop a deeper understanding of the everyday activities of peoples lives. In other words, their goal is to help researchers understand what people do – not just what they say they do. In the design field, there is an added goal: to initiate practical changes in the ways people do things in the real, material world – not just to make theoretical discoveries. Applied methods help designers conduct research projects and develop design solutions for customers, clients, or employers who seek out their expertise.
(1-2-2)

ID 517
Design Languages
Covers the rhetoric of design case making using verbal, quantitative, visual, and spatial modes of persuasion. Includes a survey of document and presentation types useful in the product development process.
(1-2-2)

ID 518
Business Frameworks
A descriptive course in business strategy for designers covering new venture strategy, competitive strategy, marketing strategy and tactics, decision sciences, entrepreneurship, private equity, business plan writing, innovation, introductory finance and self-discovery. This course will build a series of non-mathematical models of success and failure in both entrepreneurial and corporate settings.
(3-0-1.5)

ID 519
Economics and Design
This course will consider the relationship between theories and practice in the two very different realms of economics and design. Economic theory is a vital body of knowledge with many variations and emphases. It has fundamentally influenced a wide spectrum of both governmental and business policy and procedure and has enormous influence on how design is viewed in these contexts.
(3-0-1.5)

ID 520
Communication Planning
Presents and demonstrates the principles and methods of formulating a plan for a communication project, especially the relationship between the project plan and the organizations overall design strategy and policy.
(3-0-1.5)

ID 521
Product Planning
Presents and demonstrates the principles and methods of formulating a plan for a new product, especially the relationship between the project plan and the organizations overall design strategy and policy.
(3-0-1.5)

ID 522
Technological Development and Design Innovation
Concentrates on the exploitation of developments in material and manufacturing technology as a critical component in innovative design. Case studies are used to analyze the development of new products from precursor advancements in the technologies of materials and/or manufacturing. Product development is considered from perspective of project management, interactions among different technological domains, and the metaphoric transformation of design problems by design and development personnel aware of the technological advancements.
(3-0-1.5)

ID 524
Strategic Design Planning
Focuses on how the processes and goals of design planning can relate to the overall strategic plan of an organization. It includes topics related to technological innovation, market trends, financial analysis and other forces that influence the future of an organization.
(3-0-1.5)

ID 525
Design Planning and Technological Innovation
Shows how design relates to technological change in media, manufacturing and products. Special attention is paid to the confluence of computing and communication, flexible production systems and the increased use of sophisticated electronics in control systems of products.
(3-0-1.5)

ID 526
Design Planning and Market Forcs
Focuses on methods in design planning that build information about how products and information should be used. It includes a comparison of marketing and design planning as distinct processes for developing new products, services and information.
(3-0-1.5)

ID 528
Advanced Design Planning
Presents students with background information about the forces influencing a design problem. Using knowledge about planning processes, students will be asked to write a design plan that describes the relevant methods and predicted solution to the problem.
(3-0-1.5)

ID 529
Structured Planning
Introduces the basic principles and methods of Structured Planning, a set of tools used in the planning phase of the design process. Procedures are developed for exploring the issues relevant to a project, obtaining detailed functional requirements and insights, organizing this information, synthesizing innovative concepts and describing them in a Plan for the subsequent designing phase.
(3-0-1.5)

ID 530
Information Structuring
Introduces concepts for establishing relationships among elements of information and creating information structures from them. Theoretical models for measuring similarity and interaction are developed and used to create graphs representing information networks. Computer techniques are presented for decomposing these structures into clusters and hierarchically recomposing them as information structures.
(3-0-1.5)

ID 531
Computer Applications in Design
Introduces students to the construction of computer programs for design. Issues of program design are considered, including modularity, data structures, computer graphic modeling, interface design and other aspects of programming for the support of design processes. Prerequisite: ID 468 or consent of instructor.
(3-0-1.5)

ID 533
Design Analysis
A survey of design methods from many fields concentrating on problem definition, description and analysis. Among the topics covered are diagrammatic techniques for process and organizational description, semantic differential techniques, means/ends analysis and morphological analysis.
(3-0-1.5)

ID 534
Design Synthesis
A survey of design methods for enhancing creativity and developing concepts. Topics include morphological synthesis, a wide variety of creativity stimulation techniques, synectics and other group creativity processes.
(3-0-1.5)

ID 535
Decision Making in Design
This course covers methods for making decisions at various stages of a design or planning project. It provides a broad coverage on how people make decisions under varying conditions of uncertainty and complexity. There will be discussions on making design decisions based on data and alternatives available for a project. This course will also teach how to manage and lead the decision-making process in organizations.
(3-0-1.5)

ID 536
Concept Evaluation
This class will provide a framework and tools for evaluating concepts and ideas. Students first create a strategy and approach for evaluation, and then detail how to evaluate individual ideas. Clients often ask of all the ideas you produced, what is the most valuable for me? This class will propare students to answer this question.
(3-0-1.5)

ID 538
Service Design
This class will enable students to understand the fundamentals of service businesses, learn design methods applied in the service industry, and apply their design skills using the methods in a field assignment focusing on discovering and developing systematic service innovations that build the customer experience and operational efficiency in an accretive way.
(3-0-1.5)

ID 540
Advanced Communication Design
Involves students in practicing methods for rapidly developing prototypes that demonstrate appearance and/or functional aspects of potential messages. The class will include evaluation methods that are useful in the process of iteratively developing and testing alternate solutions.
(3-0-1.5)

ID 541
Advanced Product Development
Familiarizes students with the nature, methods, and design implications of current mass production practice and trends. Addresses the translation of product concepts into actual production by anticipating development needs in all portions of the manufacturing organization.
(3-0-1.5)

ID 542
Interactive Design Methods
This course focuses on a role of design to bring technologies to human contexts by creating interaction mechanisms for better user experiences. The content includes the concept of interaction, underlying theories, as well as methods for understanding user needs and contexts, representing different aspects of interaction, and designing and evaluating interactive systems.
(3-0-1.5)

ID 543
Intelligent Products
Introduces students to the professional and theoretical aspects of defining new products. Covers the process of creating a new product definition in detail, the characteristics of new product definition documents, and aspects of organizational structure and dynamics as they relate to developing new product definitions.
(3-0-1.5)

ID 544
Interface Design
Focuses on user-computer interface design. Topics included are cognitive models, interactive techniques, sign systems, display organization and prototyping methods. Prerequisite: Working knowledge of computer programming.
(3-0-1.5)

ID 545
Interactive Media
Introduces students to the principles of integrating electronic publishing, interactive video and computer graphics. Particular emphasis is on social and cognitive human factors and the use of multiple sign systems. Prerequisite: ID 544 or consent of instructor.
(3-0-1.5)

ID 546
Diagram Development
Explores the language of diagrams and alternative techniques for increasing communication effectiveness. Subjects of study include computer-based diagrams that introduce interaction and motion to convey meaning.
(3-0-1.5)

ID 547
Product Architecture and Platform
Product architecture is the structure that integrates components and subsystems of a product into a coherent mechanism to perform intended behavior and functions. It also reflects rationale and intentions of the design from different perspectives. In order to accommodate a wide range of user requirements and social concerns as well as fast changing technologies, strategic approaches and methodologies for designing product architecture and platform need to be incorporated in the design process. This course introduces the concept of product architecture and platform to explore their possible applications to different types of products from different viewpoints.
(3-0-1.5)

ID 548
Life Cycle and Sustainable Design
Life Cycle & Sustainable Design introduces students to the issues, resources, and methods of designing product systems with consideration for their environmental and social impact throughout their lifecycle. The course is formatted to help students develop a professional point of view and set of references for assessing lifecycle and sustainable issues when developing new products.
(3-0-1.5)

ID 549
Prototyping Methods
The ability to make prototypes and experiment with them before a final product is developed greatly enhances the product development process. This course introduces and explores a wide variety of prototypes and how they can be used to inform new product development. How prototyping affects understanding of the project goals, management of the process, project risk, learning, and quality are explored. Paper prototypes, architecture & platform prototypes, behavioral prototypes, interactive prototypes, visualizations, simulations are examples of the types of prototypes that are examined.
(3-0-1.5)

ID 551
Cognitive Human Factors
Presents the advanced ideas and methods that can be used to design information and products that fit the cognitive abilities of people. Important topics include designing information that corresponds to mental models of users, control systems that help users develop appropriate mental models and the analysis of different methods of representing information.
(3-0-1.5)

ID 552
Social Human Factors
Presents advanced ideas and methods used to design information, products and environments that fit the social patterns of groups. Particular attention is paid to understanding and designing systems that support group work.
(3-0-1.5)

ID 553
Cultural Human Factors
Presents ideas and principles used to understand the relationship between design and cultural values and behavior. Emphasis is placed on designing information and products for people who are from significantly different cultures.
(3-0-1.5)

ID 554
Visual Languages
Discusses pictures, abstract symbols, text, numbers, diagrams, threedimensional form and other sign systems. Particular attention is paid to the relative advantages of each representation system for conveying different types of information.
(3-0-1.5)

ID 555
Metaphor and Analogy in Design
Investigates the ideas and methods for creating visual messages through comparing, juxtaposing and substituting images within specific contexts. Discussion will include issues of similarity, such as isomorphism and analogy, the connotative attributes of images, and the dissonance found in metaphors and other rhetorical forms.
(3-0-1.5)

ID 557
Dynamic Diagrams
The study and development of realtime, computer-based diagrams for pattern finding and pattern communicating. Particular attention is paid to the roles of motion, interaction, sound, and modes of manipulation that can be combined with 3-D models and traditional diagrammatic sign systems. Prerequisite: ID 546 or consent of instructor.
(3-0-1.5)

ID 558
Theories of Information and Communication
Describes general paradigms of information and communication. Particular attention is paid to models that consider the importance of the values, behavior and knowledge of the people for whom the information is intended.
(3-0-1.5)

ID 559
Physical Human Factors
The physical aspect of human experience and interaction design is investigated through topics such as learning by doing: interaction between actions and cognition, physical interface: enhancement of cognitive activities, spatio-temporal dimensions of interaction design, and the shared reality concept for multi-modal communication.
(3-0-1.5)

ID 567
Economics of Product Development
Successful new products drive the growth and profitability of organizations. But the development of these new products relies on considered investments, quality development processes, and an expected return on the investment. This course introduces the numerous economic considerations and measures with which the successful new product developer must be familiar. Project budgeting, return on investment, net present value, cash flow analysis, product pricing, and budgeting are among the concepts explored from a design and development viewpoint.
(3-0-1.5)

ID 568
Research Methods for New Product Development
The design and development of new products requires rigorous research throughout the process to improve insight and reduce the risk of innovation. Ethnographic and activity-based methods are used early to identify latent needs. Behavioral testing with prototypes is used to understand the quality of emerging concepts. Quantitative and qualitative validation studies help understand final concepts in detailed ways. This course examines research methods used throughout the design and development process from process, financial, and results standpoints.
(3-0-1.5)

ID 569
Intellectual Property
The opportunity to protect ones unique and valuable ideas is a core tenet of the global economic system and is embodied in the laws of intellectual property. Disciplines such as design and engineering that are involved in the development of new ideas must actively purse this protection. This course introduces the principles and methods for securing intellectual property rights. Topics covered include utility and design patents, trademark, copyright, and trade dress. Emphasis is placed on the ability to articulate novelty, the appropriate process of securing intellectual property, and common ways intellectual property can be valued.
(3-0-1.5)

ID 572
Systems and Systems Theory in Design
Investigates principles and methods for exploring the behavior of systems. System dynamics techniques are used to model design concepts with the goal of revealing complex, noninceptive relationships. Important topics include general systems theory, modeling, causality and formalisms.
(3-0-1.5)

ID 577
Product Form
The form of a product is a result of resolving technical conditions, organizing the product for use, and a means for communicating. In this course students examine what technical and social dimensions impact product form and conversely, how product form can be controlled by the designer to improve the products performance. Topics include the relationship between a products form and corporate identity, visual trends, new materials, semantics, product architecture, ergonomics, specific industries, and others.
(3-0-1.5)

ID 578
Design Planning Implementation
Introduces frameworks and methods for effectively implementing change in organizations. Using cases, students will explore key failure modes, which undermine initiatives. In addition, students will identify principles, actions and measures that mitigate risk, improve implementation success, and inform stronger designs.
(3-0-1.5)

ID 579
Production Methods
An introduction to the common methods used to produce or manufacture products. Alternative processes, materials and finishing methods, relative costs and applicability to design of products will be explored.
(3-0-1.5)

ID 580
Design Workshop
Involves students from across the programs in projects that demonstrate how new theories and processes can be applied to complex design projects.
(Credit: Variable)

ID 581
Photography Workshop
Involves students in a major project that is in the context of contemporary ideas in photography.
(Credit: Variable)

ID 582
Communications Design Workshop
A project-oriented workshop focusing on design principles that link theoretical methods to practice in the area of human-centered communication design. Prerequisite: Graduate standing in design.
(Credit: Variable)

ID 583
Product Design Workshop
A project-oriented workshop focusing on design principles that link theoretical methods to practice in the area of human-centered product design. Prerequisite: Graduate standing in design.
(Credit: Varable)

ID 584
Design Planning Workshop
A project-oriented workshop that involves students in analyzing user needs, conceiving of innovations, and developing plans for new communications, products and businesses. Students will present their ideas through plans, prototypes and demonstrations. Prerequisite: Graduate standing in design.
(Credit: Variable)

ID 588
Interactive Media Workshop
A project oriented survey of the methods and issues in the creation of interactive multimedia software. Methods will cover the use of several authoring systems and the effective use and combination of the five basic data types: text, graphics, sound, animation and video. Issues addressed will be metaphor, mapping, informational organization, interactive strategies, navigation, tailoring and alternative communication models for user-controlled environments. Prerequisite: Graduate standing in design.
(Credit: Variable)

ID 589
Systems Design Workshop
Introduces the application of structured planning methods to complex design problems at the system level. Team techniques are emphasized, and formatted information handling and computer-supported structuring processes are used at appropriate stages of project definition, information development, structuring, concept development and communication. Corequisite: ID 529.
(Credit: Variable)

ID 592
Research and Demonstration Project for M.Des. Degree
(Credit: Variable)

ID 598
Special Problems
(Credit: Variable)

ID 685
Research Seminar
Investigation and discussion by faculty and students of topics of interest from different perspectives such as building a design research discourse (reading research papers critically, selecting among publication venues); investigating alternative philosophical bases for design research (comparing empirical, pragmatic, and phenomenological approaches); or exploring methodological and theoretical conflicts in design research.
(3-0-3)

ID 691
Research and Thesis for Ph.D.
(Credit: Variable)

Department of Electrical and Computer Engineering

103 Siegel Hall
3301 S. Dearborn St.
Chicago, IL 60616
312.567.3400
312.567.7995 fax
gradinfo@ece.iit.edu
www.ece.iit.edu

Interim Chair:
Geoffrey Williamson

Graduate Program Director and Associate Chair:
Jafar Saniie

The Department of Electrical and Computer Engineering offers academic programs in advanced study to graduates with technical background in preparation for careers in industry and in academic research. In addition to the doctoral and master's degrees, which are granted in recognition of research contribution and course work, the department offers a number of professional master's degrees and certificate programs to enable practicing engineers to pursue continuing education in their areas of interest.

Faculty members are engaged in research in the forefront of their fields, with funding derived from industrial and government research grants and contracts, which provide support to graduate students in the form of research assistantships, in addition to the development and the maintenance of the research facilities. The department also offers a number of fellowships and teaching assistantships on a competitive basis.

Admission to graduate study in one of the programs requires the completion of an undergraduate degree or its equivalent in electrical engineering, computer engineering, or other engineering disciplines from an accredited university. Individuals with a background in other fields of engineering are required to complete courses in the core undergraduate curriculum before commencing graduate work.

For many years, the graduate programs offered by the department have facilitated the professionals in industry to advance their knowledge through the pursuit of graduate degrees. IIT Online, the interactive distance learning facility of IIT, provides support to continuing education by making numerous courses accessible via the Internet and a regional multi-channel television network serving over 50 industrial organizations in the metropolitan Chicago area.

Degrees Offered

Master of Science in Electrical Engineering
Master of Science in Computer Engineering
Master of Science in Computer Engineering and Electrical Engineering (dual degree)
Master of Electrical and Computer Engineering
Master of Biomedical Imaging and Signals
Master of Power Engineering
Master of VLSI and Microelectronics
Master of Network Engineering
Doctor of Philosophy in Electrical Engineering
Doctor of Philosophy in Computer Engineering

Joint Degree Programs

With the Department of Computer Science:
Master of Telecommunications and Software Engineering

With Center for Financial Markets:
Master of Electricity Markets

Certificate Programs

Advanced Electronics
Applied Electromagnetics
Communication Systems
Computer Engineering
Control Systems
Electricity Markets
Power Electronics
Power Engineering
Signal Processing
Wireless Communications Engineering

Interdisciplinary Programs

Master of Science in Electrical Engineering with specialization in Energy/Environment/Economics (E^3)

Research Centers and Facilities

The department operates research laboratories for work in CAD for VLSI and SoC design, communications, computer networking, embedded computing, image processing and medical imaging, microwave electronics, power systems, signal processing and ultrasonic imaging. The Electric Power and Power Electronics Center supports research initiatives with support from industry and government in the areas of power systems, power electronics, electric machines, motor drives, and vehicular power systems. The department also collaborates with and utilizes the research resources of the Pritzker Institute of Biomedical Science and Engineering and nearby national laboratories.

The department has state-of-the-art computer systems to enhance and extend the generally available system in the university. A primary resource is a network of more than 100 high-performance workstations, file servers, and computer servers, running the Unix/Linux operating system. With mass storage, CD-ROM drives, tape drives, and accelerated graphics, these systems provide students and researchers with an array of software tools including: programming languages (C, C++, Java, FORTRAN, Python, Perl, etc.), software development tools, software and hardware simulators, and electronic computer-aided design packages from companies such as Cadence, Synopsys, Avanti, Synplicity, Xilinx, Altera, Mentor Graphics, EPRI, and ESCA.

In addition to the workstations, the department maintains a collection of PCs for ECE students, including a set of machines that can be dedicated to hardware/software projects. The computers are connected via high-speed Ethernet, which in turn is connected to the university's backbone and the Internet.

Research Areas

Active research programs are conducted in the general areas of communication systems; computer systems and micro-electronics; electromagnetics and electronics; power and control systems; signal and image processing.

Faculty

Mark Anastasio, Associate Professor. B.S., Illinois Institute of Technology; M.S.E., University of Pennsylvania; Ph.D., University of Chicago. Tomographic reconstruction algorithm, numerical analysis of inverse problem in biomedical inaging, theoretical imaging science.

Tricha Anjali, Assistant Professor. M. Tech. in Electrical Engineering, Indian Institute of Technology; Ph.D., Georgia Institute of Technology. Broadband networks, adaptive network management and optical networks.

Robert Arzbaecher, Emeritus Professor. Ph.D., University of Illinois, Urbana-Champaign, Instrumentation, signal procesing and control.

Guillermo E. Atkin, Associate Professor. B.S., Universidad F. Santa Maria (Chile); Ph.D., University of Waterloo (Canada). Modulation and coding, digital mobile and wireless communication, spreadspectrum and optical communication systems.

Suresh Borkar, Senior Lecturer. B. Tech (EE) Indian Institute of Technology (India); MS and Ph.D., Illinois Institute of Technology, Wireless and wireline telecommunications, operating systems, architecture, and performance of computer and network systems.

Jovan G. Brankov, Research Assistant Professor. Dipl. Ing., Electrical Engineering, University of Belgrade; M.Sc., Ph.D., Illinois Institute of Technology. Medical imaging, image sequence processing, pattern recognition and data mining.

Yu Cheng, Assistant Professor. B.E. and M.E., Tsinghua University (China); Ph.D. the University of Waterloo (Canada), Computer network management, Internet measurement, performance analysis, and quality of service provisioning, wireless networks, and wireless/wireline interworking.

Ken Choi, Assistant Professor, B.S., M.S., Kyung Hee University (Korea); Ph.D., Georgia Institute of Technology. VLSI design and automation for low power.

Ali Emadi, Professor, B.S., M.S., Sharif University of Technology (Iran); Ph.D., Texas A&M University. Power electronics, motor drives, electric machines, vehicular power systems.

Alexander J. Flueck, Associate Professor. B.S., M.E., Ph.D., Cornell University. Power systems, computational methods, control systems.

Alireza Khaligh, Assistant Professor. B.S., M.S., Sharif Univeristy (Iran); Ph.D., Illinois Institute of Technology. Power electronics, energy systems, energy scavenging, and design of energy-efficient power supplies.

Joohee Kim, Assistant Professor. B.S., M.S., Yonsei University (Korea); Ph.D., Georgia Institute of Technology. Image/video signal processing and coding for multimedia networking.

Mahesh Kirshnamurthy, Assistant Professor. B.S., Amrawati University (India); M.S., University of Missouri- Rolla; Ph.D., University of Texas-Arlington. Embedded systems for renewable energy and vehicular applications and power electronics for vehicular applications.

Zuyi Li, Assistant Professor. B.S. (EE), Shanghai Jiaotong University (China); M.S., Tsinghua University (China); Ph.D., Illinois Institute of Technology. Market operation of electric power system, security-constrained unit commitment, arbitrage in electricity market, market power analysis and risk management, ancillary services auction, transmission pricing.

Erdal Oruklu, Assistant Professor. B.S., Technical University of Istanbul (Turkey); M.S., Bogazici University (Turkey); Ph.D., Illinois Institute of Technology. VLSI and SoC design, signal processing architectures, digital arithmetic, computer systems.

Kui Ren, Assistant Professor. B.S., M.S., Zheiang University (China); Ph.D., Worcester Polytechnic Institute. Network security, wireless networks, Internet security, information assurance, and applied cryptography.

Gerald F. Saletta, EmeritusProfessor. B.S., M.S., University of Notre Dame; Ph.D., Illinois Institute of Technology. Electronics, digital systems.

Jafar Saniie, Filmer Professor, Associate Chair, Graduate Program Director, and Computer Engineering Director. B.S., University of Maryland; M.S., Case Western Reserve University; Ph.D., Purdue University. Embedded computing, DSP architectures, signal and image processing, detection and estimation, ultrasonic imaging for both medical and industrial applications.

Mohammad Shahidehpour, Carl and Paul Bodine Professor, and Department Chair. B.S., Arya-Mehr University of Technology (Iran); M.S., Ph.D., University of Missouri, Columbia. Large-scale power systems, nonlinear stochastic systems, optimization theory.

Hassan Shanechi, Senior Lecturer. B.S., M.S., Tehran University (Iran); Ph.D., Michigan State University. Nonlinear and intelligent systems, power system dynamics and security.

Henry Stark, Emeritus Professor. B.E.E., City College of New York; M.S., D.Eng.Sc., Columbia University. Image reconstruction, medical imaging, pattern recognition, signal processing and sampling theory, optics.

Jia Wang, Assistant Professor. B.S., Tsinghua University (China); M.S., Ph.D., Northwestern University. VLSI, design automation, and algorithm design.

Erwin W. Weber, Emeritus Professor, B.S., M.S., Ph.D., Illinois Institute of Technology, Electromagnetics, RF electronics, antenna theory.

Miles Wernick, Professor and Director of Medical Imaging. B.A., Northwestern University; Ph.D., University of Rochester. Medical imaging, image processing, pattern recognition.

Geoffrey Williamson, Professor. B.S., M.S., Ph.D., Cornell University. Adaptive filtering, signal processing and control, parameter estimation and system identification, control systems, robust control theory.

Thomas T. Y. Wong, Professor. B.S., University of Hong Kong; M.S., Ph.D., Northwestern University. Microwave communications systems, nonlinear device measurement, semiconductor device theory, microwave electronics and instrumentation.

Yongyi Yang, Professor. B.S., M.S., Northern Jiatong University (China); M.S., Ph.D., Illinois Institute of Technology. Image and signal processing, data compression, applied mathematical and statistical methods.

Yang Xu, Assistant Professor. B.S., M.S., Fudan University (China); Ph.D., Carnegie Mellon University. RFIC design for digital communications and wireless medical technology.

Imam Samil Yetik, Assistant Professor. B.S., Bogazici University (Turkey), M.S., Bilkent University (Turkey), Ph.D., University of Illinois at Chicago, Statistical signal and image processing with applications to biomedicine.

Chi Zhou, Assistant Professor. B.S., Tsinghua University (China), M.S. and Ph.D., Northwestern University, Resource allocation and power control for multimedia cellular networks, integration of 3G, WLAN, WiMAX and SONET, sensor networks, jamming avoidance over OFDM or MIMO systems.

Admission Requirements

Cumulative undergraduate GPAminimum: 3.0/4.0 GRE minimum score:
M.S./MAS: 1100 (quantitative + verbal) 3.5 (analytical writing)
Ph.D.: 1100 (quantitative + verbal) 3.5 (analytical writing)
TOEFL minimum score: 550/213/80*

Meeting the minimum GPA and test score requirements does not guarantee admission. Test scores and GPA are just two of several important factors considered. Professional Master's degrees in electrical and computer engineering, network engineering, telecommunication and software engineering, and electricity markets do not require GRE scores for applicants who hold undergraduate degrees from universities in the United States with a minimum cumulative GPAof 3.0/4.0.

Admission to the master's degree programs normally requires a bachelor's degree from an accredited institution in electrical engineering or computer engineering. Applicants with backgrounds in other fields with proficiency in engineering sciences, physics, mathematics or computer science, gained through prior coursework or professional experience, are also eligible for admission, but will be required to demonstrate proficiency in the subject matter covered in undergraduate courses that are prerequisites for the chosen graduate program.

Proficiency may be demonstrated by passing a written exam or by taking and passing, with a grade of B or better, prerequisite undergraduate courses at IIT. Specific course prerequisites for each degree program are listed within the program description.

Admission to the doctoral program requires a master's degree. Each entering degree-seeking graduate student is assigned a temporary academic adviser who will provide initial guidance to the candidate. As their research and other academic interests become defined, students may opt to select a new permanent advisor.

Non-degree graduate students should consult with the department advisor. Students are responsible for following the guidelines of the graduate programs set by the department, in conjunction with the regulations of the Graduate College.

*Paper-based test score/computer-based test score/internet-based test score.

Master of Science in Electrical Engineering

32 credit hours
Thesis option

The purpose of this degree is to prepare students for advanced study and/or research and industry in the field of electrical engineering. The Master of Science in Electrical Engineering (M.S.E.E.) is a degree program combining breadth across several areas of study within electrical engineering and specialization within one area, which includes an option to pursue thesis research under the guidance of a faculty advisor. Areas of study include communication and signal processing; computers and microelectronics; and power and control systems. The program is normally completed in three semesters of full-time study.

Students whose accredited B.S. degree is not in electrical engineering may pursue the M.S.E.E. provided that they have an adequate background and can demonstrate proficiency in the material contained in undergraduate courses equivalent to IIT's ECE 211 and ECE 213 (Circuit Analysis I and II), ECE 218 (Digital Systems), ECE 307 (Electrodynamics), ECE 308 (Signals and Systems), ECE 311 (Engineering Electronics), MATH 251 (Multivariate and Vector Calculus), and MATH 252 (Introduction to Differential Equations).

A student may demonstrate proficiency by successfully completing the courses or by demonstrating satisfactory performance in one or more special examinations administered by the department. The program of study includes a minimum of 32 credit hours of acceptable graduate coursework, with a minimum of 20 credit hours of ECE courses at the 500-level or higher. Up to six credits of ECE short courses may be applied to the degree.

Students, with their advisor, select courses appropriate to their needs and interests. The program of study must include four courses within one of the electrical engineering (EE) areas of concentration listed below and one course from each of the two remaining areas. An M.S.E.E. candidate may, with permission of a thesis advisor, include in his or her program a thesis of six to eight credit hours. The master's thesis is recommended for pre-doctoral students. The thesis option requires a written thesis and an oral defense of the thesis. Thesis format and deadlines are set by the Graduate College.

M.S. in Electrical Engineering Areas of Concentration

I. Communications and Signal Processing

ECE 401 Communication Electronics
ECE 403 Digital and Data Communication Systems
ECE 405 Digital and Data Communication Systems with Laboratory
ECE 421 Microwave Circuits and Systems
ECE 423 Microwave Circuits and Systems with Laboratory
ECE 436 Digital Signal Processing I with Laboratory
ECE 437 Digital Signal Processing I
ECE 481 Image Processing
ECE 504 Wireless Communication System Design
ECE 507 Imaging Theory and Applications
ECE 508 Video Communications
ECE 509 Electromagnetic Field Theory
ECE 511 Analysis of Random Signals
ECE 513 Communication Engineering Fundamentals
ECE 514 Digital Communication Principles
ECE 515 Modern Digital Communications
ECE 519 Coding for Reliable Communications
ECE 522 Electromagnetic Compatibility
ECE 565 Computer Vision and Image Processing
ECE 566 Statistical Pattern Recognition
ECE 567 Statistical Signal Processing
ECE 568 Digital Speech Processing
ECE 569 Digital Signal Processing II
ECE 570 Fiber Optic Communication Systems
ECE 576 Antenna Theory
ECE 578 Microwave Theory

II. Computers and Microelectronics

ECE 407 Introduction to Computer Networks with Laboratory
ECE 408 Introduction to Computer Networks
ECE 415 Solid-State Electronics
ECE 425 Analysis and Design of Integrated Circuits
ECE 429 Introduction to VLSI Design
ECE 441 Microcomputers
ECE 446 Advanced Logic Design
ECE 449 Object-Oriented Programming and Computer Simulation
ECE 485 Computer Organization and Design
ECE 502 Basic Network Theory
ECE 521 Quantum Electronics
ECE 524 Advanced Electronic Circuit Design
ECE 525 RF Integrated Circuit Design
ECE 526 Active Filter Design
ECE 527 Performance Analysis of RF Integrated Circuits
ECE 529 Advanced VLSI Systems Design
ECE 530 High Performance VLSI/IC Systems
ECE 541 Performance Evaluations of Computer Networks
ECE 542 Design and Optimization of Computer Networks
ECE 543 Computer Network Security
ECE 544 Wireless and Mobile Networks
ECE 545 Advanced Computer Networks
ECE 546 Wireless Network Security
ECE 571 Nanodevices and Technology
ECE 575 Electron Devices
ECE 583 High Speed Computer Arithmetic
ECE 584 VLSI Architectures for Signal Processing and Communications
ECE 585 Advanced Computer Architecture
ECE 586 Fault Detection in Digital Circuits
ECE 587 Hardware/Software Codesign
ECE 588 CAD Techniques for VLSI Design
ECE 589 Computer-Aided Design of Analog IC

III. Power and Control

ECE 411 Power Electronics
ECE 412 Electric Motor Drives
ECE 417 Power Distribution Engineering
ECE 418 Power Systems Analysis
ECE 419 Power Systems Analysis with Laboratory
ECE 420 Analytical Methods in Power Systems
ECE 438 Control Systems
ECE 505 Applied Optimization for Engineers
ECE 506 Analysis of Nonlinear Systems
ECE 531 Linear System Theory
ECE 535 Discrete Time Systems
ECE 538 Renewable Energies
ECE 539 Computer Aided Design of Electric Machines
ECE 540 Reliability Theory and System Implementation
ECE 548 Energy Harvesting
ECE 549 Motion Control Systems Dynamics
ECE 550 Power Electronic Dynamics and Control
ECE 551 Advanced Power Electronics
ECE 552 Adjustable Speed Drives
ECE 553 Power System Planning
ECE 554 Power Systems Relaying
ECE 555 Power Market Operations
ECE 556 Power Market Economics and Security
ECE 557 Fault-Tolerant Power Systems
ECE 558 Power System Reliability
ECE 559 High-Voltage Power Transmission
ECE 560 Power Systems Dynamics and Stability
ECE 561 Deregulated Power Systems
ECE 562 Power System Transaction Management
ECE 563 Computational Intelligence in Engineering
ECE 564 Control and Operation of Electric Power Systems
ECE 580 Elements of Sustainable Energy
ECE 581 Elements of Smart Grid

Master of Science in Computer Engineering

32 credit hours
Thesis option

The purpose of this degree is to prepare students for advanced study and/or research and industry in the field of computer engineering. The Master of Science in Computer Engineering (M.S.CP.E.) program builds a strong foundation in all aspects of the design and development of computer systems, with a specialization in a major area. Students have the option to pursue thesis research under the guidance of a faculty advisor. Areas of study include computer hardware design, computer networking and telecommunications, and computer system and application software. The program is normally completed in three semesters of full-time study. Students whose accredited B.S. degree is not in computer engineering may pursue the M.S.CP.E., provided that they have an adequate background and can demonstrate proficiency in the material contained in the following undergraduate courses: ECE 211 and ECE 213 (Circuit Analysis I and II), ECE 218 (Digital Systems), ECE 242 or CS 350 (Digital Computers and Computing), ECE 311 (Engineering Electronics), CS 201 (i.e., CS 115 and CS 116 combined, Object Oriented Programming I-II), CS 401 (Introduction to Advanced Studies in CS), and MATH 252 (Introduction to Differential Equations). A student may demonstrate proficiency by successfully completing the courses or by demonstrating satisfactory performance in one or more special examinations administered by the department.

The program of study includes a minimum of 32 credit hours of acceptable graduate coursework, with a minimum of 21 credit hours of ECE coursework. A minimum of 20 credit hours must be taken at the 500-level or higher excluding short courses and Master's Seminar. Up to two credits of master's seminar (ECE 595 or ECE 596), and up to six credits of ECE short courses may be applied to the degree. Students, in consultation with their advisor, select courses appropriate to their needs and interests. The program of study must include two core and two elective courses within one of the following computer engineering (CPE) areas of concentration, and at least one core course from the remaining two areas.

An M.S.CP.E candidate may, with permission of a thesis advisor, include in his or her program a thesis of six to eight credit hours. The master's thesis is strongly recommended for pre-doctoral students. The thesis option requires a written thesis and an oral defense of the thesis. Thesis format and deadlines are set by the Graduate College.

M.S. in Computer Engineering Areas of Concentration and Curriculum

Computer Hardware Design

Core courses

ECE 529 Advanced VLSI Systems Design
AND/OR
ECE 429 Introduction to VLSI Design
AND
ECE 585 Advanced Computer Architecture

Elective courses

ECE 425 Analysis and Design of Integrated Circuits
ECE 441 Microcomputers
ECE 446 Advanced Logic Design
ECE 485 Computer Organization and Design
ECE 530 High Performance VLSI/IC Systems
ECE 583 High Speed Computer Arithmetic
ECE 584 VLSI Architectures for Signal Processing and Communications
ECE 585 Advanced Computer Architecture
ECE 586 Fault Detection in Digital Circuits
ECE 587 Hardware/Software Codesign
ECE 588 CAD Techniques for VLSI Design

Computer Systems Software

Core courses

CS 550 Comparative Operating Systems
CS 551 Operating System Design and Implementation

Elective courses

ECE 449 Object-Oriented Programming and Computer Simulation
ECE 587 Hardware/Software Codesign
CS 487 Software Engineering I
CS 545 Distributed Computing Landscape
CS 546 Parallel and Distributed Processing
CS 555 Analytic Models and Simulation of Computer Systems
CS 586 Software Systems Architectures
CS 587 Software Project Management
CS 588 Advanced Software Engineering Development
CS 589 Software Testing and Analysis

Networks and Telecommunications

Core courses

ECE 407 Introduction to Computer Networks with Laboratory **OR**
ECE 408 Introduction to Computer Networks
ECE 545 Advanced Computer Networks
AND
ECE 541 Performance Evaluation of Computer Networks
AND/OR
ECE 542 Design and Optimization of Computer Networks

Elective courses

ECE 504 Wireless Communication System Design
ECE 508 Video Communications
ECE 511 Analysis of Random Signals
ECE 513 Communication Engineering Fundamentals
ECE 514 Digital Communication Principles
ECE 515 Modern Digital Communications
ECE 519 Coding for Reliable Communications
ECE 543 Computer Network Security
ECE 544 Wireless and Mobile Networks
ECE 546 Wireless Network Security
ECE 570 Fiber Optic Communication Systems
ECE 584 VLSI Architectures for Signal Processing and Communications
CS 455 Data Communications
CS 544 Computer Networks II: Network Services

Master of Science in Computer Engineering and Electrical Engineering

dual degree
30 credit hours
Thesis option

The purpose of the Master of Science in Computer Engineering and Electrical Engineering (M.S.CP.E./E.E.) is to prepare students for advanced study and/or research, or for industry in the field of both computer and electrical engineering. The M.S.CP.E./E.E. program provides for a strong foundation in all aspects of the design and development of computer systems, and also offers several areas of study within electrical engineering. There is also an option to pursue thesis research under the guidance of a faculty advisor.

There is a growing need for engineers with a strong educational background in both computer engineering and electrical engineering. In the M.S.CP.E./E.E. program students will be introduced to topics important to the computer engineering field such as computer hardware design, computer networks and software engineering, as well as topics in electrical engineering such as communications and signal processing, electronics and electromagnetics, and power and control systems. The program of study includes a minimum of 45 credit hours of acceptable graduate coursework in both computer engineering and electrical engineering. M.S.CP.E./E.E. degree requirements are described in the section below. Requirements for the M.S.CP.E./E.E. fully satisfy the existing requirements for an M.S. in Computer Engineering and an M.S. in Electrical Engineering. The program is normally completed in four semesters of full-time study.

Admission requirements for the CPE/EE are the same as those for admission to the Master of Science in Computer Engineering or electrical engineering. Students whose accredited B.S. degree is not in computer and/or electrical engineering may pursue the CPE/EE degree, provided that they have an adequate background and can demonstrate proficiency in the material contained in the following undergraduate courses: ECE 211 and ECE 213 (Circuit Analysis I and II), ECE 218 (Digital Systems), ECE 242 or CS 350 (Digital Computers and Computing), ECE 311 (Engineering Electronics), CS 201 (i.e., CS 115 and CS 116 combined, Object Oriented Programming III), CS 401 (Introduction to Advanced Studies in CS), and MATH 252 (Introduction to Differential Equations). A student may demonstrate proficiency by successfully completing the courses or by demonstrating satisfactory performance in one or more special examinations administered by the department.

The description of the CPE areas of concentration is in the Master of Science in Computer Engineering section. A description of the EE areas of concentration is in the Master of Science in Electrical Engineering section.

In addition to all university requirements for a Master of Science degree, the M.S.CP.E./E.E. degree has the following requirements:

1. A minimum of 45 credit hours of graduate level coursework including:

Two core courses in a CPE major area, chosen from among the CPE areas of concentration.

Two elective courses in the CPE major area, chosen from among the CPE areas of concentration.

One core course from each of two remaining areas of CPE concentration.

Four (or more) courses within an EE major area, chosen from among the EE areas of concentration (Areas I, II and III).

One (or more) course(s) in each of two EE minor areas, chosen from among the Areas I, II and III outside the major.

One advanced mathematics course required for EE major area unless included in the B.S. degree.

Additional coursework approved by the academic advisor

The CPE/EE Program is subject to the following restrictions: a minimum of 30 credit hours of coursework at the 500-level or higher; at least 30 credit hours of ECE courses excluding short courses and Master's Seminars; no more than six credit hours of ECE short courses; six to eight credit hours of research work (ECE 591) leading to an M.S. dissertation may be included with the approval of a thesis advisor; and a maximum of two credits of a Master's Seminar (ECE 595 and ECE 596)

2. A GPA of at least 3.0/4.0 (excluding prerequisites and proficiencies).

Courses classified in two areas may be applied to only one area to fulfill requirements. Intersession short courses may not be used to satisfy distribution requirements in major and minor areas.

Each regular (matriculated) graduate student is assigned an academic advisor, indicated in his/her formal letter of admission to the master's program.

Students should consult with their academic advisor to file a program of study meeting these requirements prior to four months after initial registration for full-time students and prior to enrolling beyond 12 credits for part-time students.

Master of Electrical and Computer Engineering

30 credit hours

The purpose of this degree is to prepare students for leading edge positions in industry in the field of electrical and computer engineering. The Master of Electrical and Computer Engineering (M.E.C.E.) is a course-only degree program that prepares students for professional practice in electrical and computer engineering. The program can be completed in one year of full-time study. Students whose accredited B.S. degree is not in electrical engineering or computer engineering may pursue the M.E.C.E. provided that they have an adequate background and can demonstrate proficiency in the material contained in undergraduate courses equivalent to IITs ECE 211 and ECE 213 (Circuit Analysis I and II), ECE 218 (Digital Systems), ECE 307 (Electrodynamics), ECE 308 (Signals and Systems), ECE 311 (Engineering Electronics), MATH 251 (Multivariate and Vector Calculus), and MATH 252 (Introduction to Differential Equations). Students should visit the appropriate department for course descriptions. A student may demonstrate proficiency by successfully completing the courses or by demonstrating satisfactory performance in one or more special examinations administered by the department.

The program of study includes a minimum of 30 credit hours of acceptable graduate coursework, with a minimum of 24 credit hours in electrical and computer engineering and a minimum of 18 credit hours at the 500-level or higher. Up to six credits of ECE short courses may be applied to the degree. Students arrange their program of study in consultation with their advisor and typically elect to build their program to emphasize one or more areas of specialization. No formal distribution requirements are imposed. Areas of specialization include communication systems, computer communication, computer engineering, control systems, electromagnetics, electronics, networks, photonics and optics, power systems and signal processing

Master of Biomedical Imaging and Signals

30 credit hours

The purpose of this degree program is to prepare students for leading edge positions in industry in the areas of biomedical imaging and signal processing. The Professional Master of Biomedical Imaging and Signals is a course-only degree program that prepares students for professional practice.

The interdisciplinary nature of bioengineering generally involves many facets of electrical and computer engineering. The Department of Electrical and Computer Engineering offers several courses and research opportunities that engage students interested in biomedical engineering. In addition, there are a significant number of courses offered by the Biomedical Engineering Department and other disciplines at IIT which are of great importance to students interested in the professional master's degree in biomedical engineering with specialization in medical imaging and bio-signals.

The admission requirements for the proposed degree will follow the existing admission requirements for such professional master's degrees in ECE Department. Students whose accredited B.S. degree is not in electrical and computer engineering may pursue the professional master's degree provided that they have an adequate background and can demonstrate proficiency in the material contained in undergraduate courses equivalent to IIT's ECE 211 and ECE 213 (Circuit Analysis I and II), ECE 218 (Digital Systems), ECE 307 (Electrodynamics), ECE 308 (Signals and Systems), ECE 311 (Engineering Electronics), BIOL 107 (General Biology Lectures), MATH 251 (Multivariate and Vector Calculus), and MATH 252 (Introduction to Differential Equations). A student may demonstrate proficiency by successfully completing the courses or by demonstrating satisfactory performance in one or more special examinations administered by the department. Students can pursue a professional master's degree in the area of Biomedical Imaging and Signals by completing the required core and elective courses.

Required courses

ECE 511 Analysis of Random Signals
ECE 565 Computer Vision and Image Processing
AND/OR
ECE 481 Image Processing
ECE 569 Digital Signal Processing II
AND/OR
ECE 437 Digital Signal Processing I
BME 450 Physiology
OR
BIOL 430 Animal Physiology

ECE Elective courses (2 courses minimum)

ECE 505 Applied Optimization for Engineers
ECE 566 Statistical Pattern Recognition
ECE 567 Statistical Signal Processing
ECE 568 Digital Speech Processing
ECE 597 Special Project in Biomedical Imaging and Signals

BME Elective courses (1 course minimum)

BME 430 Concepts of Medical Engineering
BME 501 Biomedical Instrumentation
BME 532 Medical Imaging Science
BME 535 Magnetic Resonance Imaging
BME 538 Neuroimaging
BME 540 Wave Physics and Applied Optics for Imaging Scientists
BME 551 Physiological Signal Analysis & Control Theory I
BME 552 Physiological Signal Analysis & Control Theory II

Master of Power Engineering

30 credit hours

The purpose of this degree program is to prepare students for leading edge positions in industry in the areas of electric power, power electronics, motor drives, and electric machines. The Professional Master of Power Engineering is a course-only degree program that prepares students for professional practice in power engineering.

The admission requirements for the proposed degree will follow the existing admission requirements for such professional master's degrees in ECE Department. Students whose accredited B.S. degree is not in electrical engineering may pursue the professional masters degree provided that they have an adequate background and can demonstrate proficiency in the material contained in undergraduate courses equivalent to IITs ECE 211 and ECE 213 (Circuit Analysis I and II), ECE 311 (Engineering Electronics), ECE 319 (Fundamentals of Power Engineering), MATH 251 (Multivariate and Vector Calculus), and MATH 252 (Introduction to Differential Equations). A student may demonstrate proficiency by successfully completing the courses or by demonstrating satisfactory performance in one or more special examinations administered by the ECE department.

The program of study includes a minimum of 30 credit hours of acceptable coursework with a minimum of 24 credit hours from the following list of core and elective courses (up to 6 credit hours may be selected from other ECE courses). A minimum of 18 credit hours at the 500-level or higher must be selected. Up to 2 credit hours of theMasters Seminar (ECE 595 or ECE 596), up to 3 credit hours of a Graduate Special Project in power engineering (ECE 594 or ECE 597), and up to 6 credit hours of ECE short courses may be applied to the degree.

Required courses
(3 courses minimum)

ECE 412 Electric Motor Drives
ECE 418 Power Systems Analysis
OR
ECE 419 Power Systems Analysis
ECE 551 Advanced Power Electronics
AND/OR
ECE 411 Power Electronics
ECE 564 Control and Operation of Electric Power Systems
AND/OR
ECE 420 Analytical Methods in Power Systems

Elective courses in Power Systems
(2 courses minimum)

ECE 417 Power Distribution Engineering
ECE 420 Analytical Methods in Power Systems
ECE 553 Power System Planning
ECE 554 Power Systems Relaying
ECE 555 Power Market Operations
ECE 556 Power Market Economics and Security
ECE 557 Fault-Tolerant Power Systems
ECE 558 Power System Reliability
ECE 559 High-Voltage Power Transmission
ECE 560 Power Systems Dynamics and Stability
ECE 561 Deregulated Power Systems
ECE 562 Power System Transaction Management
ECE 563 Computational Intelligence in Engineering
CHE 543 Energy, Environment and Economics

Elective courses in Power Electronics and Motor Drives
(2 courses minimum)

ECE 437 Digital Signal Processing I
ECE 438 Control Systems
ECE 531 Linear System Theory
ECE 549 Motion Control Systems Dynamics
ECE 550 Power Electronic Dynamics and Control
ECE 552 Adjustable Speed Drives
ECE 762 Industrial Applications of Power Electronics and Motor Drives
ECE 764 Vehicular Power Systems
CHE 541 Renewable Energy Technologies
CHE 524 Design Building Enclosures

Master of VLSI and Microelectronics

30 credit hours

The purpose of this degree program is to prepare students for leading edge positions in industry in the areas of VLSI and microelectronics. The Professional Master of VLSI and Microelectronics is a course-only degree program that prepares students for professional practice. Students can pursue a professional master's degree in the area of VLSI and Microelectronics by completing the required core courses; ECE 425, ECE 429, ECE 529, and ECE 575 (and/or ECE 415) and selecting six additional courses from a combination of computer engineering electives, electronics electives, and other areas in electrical and computer engineering. A minimum of 18 credit hours at the 500-level or higher must be selected. With advisor approval the student may take up to two ECE courses in other areas of electrical and computer engineering such as signal processing, communications, power and control.

The admission requirements for the proposed degree will follow the existing admission requirements for such professional masters degrees in ECE Department. Students whose accredited B.S. degree is not in electrical engineering may pursue the professional master's degree provided that they have an adequate background and can demonstrate proficiency in the material contained in undergraduate courses equivalent to IITs ECE 211 and ECE 213 (Circuit Analysis I and II), ECE 218 (Digital Systems), ECE 307 (Electrodynamics), ECE 308 (Signals and Systems), ECE 311 (Engineering Electronics), MATH 251 (Multivariate and Vector Calculus), and MATH 252 (Introduction to Differential Equations). A student may demonstrate proficiency by successfully completing the courses or by demonstrating satisfactory performance in one or more special examinations administered by the ECE department.

Required courses
(2 courses minimum)

ECE 425 Analysis and Design of Integrated Circuits
ECE 429 Introduction to VLSI Design
ECE 529 Advanced VLSI Systems Design
ECE 575 Advanced Power Electronics
AND/OR
ECE 415 Solid-State Electronics

Elective courses in Computer Engineering
(1 course minimum)

ECE 485 Computer Organization and Design
ECE 530 High Performance VLSI/IC Systems
ECE 542 Design and Optimization of Computer Networks
ECE 545 Advanced Computer Networks
ECE 583 High Speed Computer Arithmetic
ECE 584 VLSI Architectures for Signal Processing and Communications
ECE 585 Advanced Computer Architecture
ECE 586 Fault Detection in Digital Circuits
ECE 587 Hardware/Software Co-design
ECE 588 CAD Techniques for VLSI Design
ECE 589 Computer Aided-Design of Analog IC

Elective courses in Electronics
(1 course minimum)

ECE 521 Quantum Electronics
ECE 524 Advanced Electronic Circuit Design
ECE 525 RF Integrated Circuit Design
ECE 526 Active Filter Design
ECE 527 Performance Analysis of RF Integrated Circuits
ECE 551 Advanced Power Electronics
ECE 570 Fiber Optic Communication Systems
ECE 571 Nanodevices and Technology
ECE 578 Microwave Theory
ECE 579 Numcrical Methods in Electromagnetics and Solid-State Electronics

Master of Network Engineering

30 credit hours

The Master of Network Engineering (M.N.E.) is a course only degree program that prepares students for professional practice in network engineering and information technologies. The program offered by the Department of Electrical and Computer Engineering (ECE) can be completed in one year of full-time study. A person holding a B.S.E.E. or a B.S.CP.E degree has the necessary background to undertake the M.N.E. program. A student without adequate background is required to demonstrate proficiency in the following courses: ECE 211 (Circuit Analysis I), ECE 213 (Circuit Analysis II), ECE 308 (Signals and Systems), MATH 252 (Introduction to Differential Equations) MATH 474 (Probability), and CS 401 (Introduction to Advanced Studies in Computer Science). A student may demonstrate proficiency by successfully completing the courses or by demonstrating satisfactory performance in one or more special examinations administered by the department.

The M.N.E. is a focused professional master's degree requiring a minimum of 30 credit hours of advisorapproved coursework. The M.N.E. program of studies must include a minimum of 24 credit hours of ECE coursework, 12 credit hours of required core courses, 12 credit hours of MNE elective courses, and six credit hours of advisor approved elective courses. At least 18 credit hours of the courses must be at the 500 level. A maximum of six credit hours may be taken from the ECE 700-level short courses.

Required courses
(12 credit hours)

ECE 407 Introduction to Computer Networks with Laboratory
OR
ECE 408 Introduction to Computer Networks
AND/OR
ECE 545 Advanced Computer Networks
AND
ECE 511 Analysis of Random Signals
ECE 513 Communication Engineering Fundamentals
ECE 541 Performance Evaluation of Computer Networks
AND/OR
ECE 542 Design and Optimization of Computer Networks

Elective courses
(12 credit hours)

This coursework is taken from the 400-, and 500-level courses listed below, and approved by the M.N.E. advisor. A maximum of six credit hours of ECE short courses can be included in the M.N.E. program of studies.

ECE 403 Communication Systems
ECE 404 Digital and Data Communications
ECE 437 Digital Signal Processing I
OR
ECE 436 Digital Signal Processing I with Laboratory
ECE 485 Computer Organization and Design
ECE 504 Wireless Communication System Design
ECE 508 Video Communications
ECE 514 Digital Communication Principles
ECE 515 Modern Digital Communications
ECE 519 Coding for Reliable Communications
ECE 543 Computer Network Security
ECE 544 Wireless and Mobile Networks
ECE 546 Wireless Network Security
ECE 565 Computer Vision and Image Processing
ECE 568 Digital Speech Processing
ECE 569 Digital Signal Processing II
ECE 570 Fiber-Optic Communication Systems
ECE 583 High Speed Computer Arithmetic
ECE 584 VLSI Architectures for Signal Processing and Communications
ECE 585 Digital Computer Design
CS 455 Data Communications
CS 548 Broadband Networks

Master of Telecommunications and Software Engineering

30 credit hours

The Master of Telecommunications and Software Engineering (M.T.S.E.) is a course-only degree program that prepares students for professional practice in telecommunications and information technologies. The program, jointly offered by the Department of Electrical and Computer Engineering (ECE) and Department of Computer Science (CS), can be completed in one year of full-time study.

Eligibility: A person holding a B.S.E.E., a B.S.CP.E. or a B.S.C.S. degree has the necessary broad background to undertake the M.T.S.E. program. A student without adequate background in specific areas is required to demonstrate proficiency in prerequisite courses; an abbreviated list is given below.

Specific proficiency courses will be detailed for each student at the time of admission to the M.T.S.E. program. A student may demonstrate proficiency by successfully completing the courses or by demonstrating satisfactory performance in one or more special examinations administered by the department.

Computer science prerequisites

CS 201 (i.e., CS 115 and CS 116 combined, Object-Oriented Programming I-II)
CS 401 Introduction to Advanced Studies

Electrical and Computer Engineering prerequisites

ECE 211 Circuit Analysis I
ECE 213 Circuit Analysis II
ECE 308 Signals and Systems
MATH 252 Introduction to Differential Equations
MATH 474 Probability

The M.T.S.E. is a professional master's degree requiring a minimum of 30 credit hours of advisor-approved coursework. The M.T.S.E. program of studies must include a minimum of 15 credit hours of ECE coursework and a minimum of 12 credit hours of computer science coursework.

Five required courses and one elective course from each of the three categories given below must appear on the M.T.S.E. program of studies.

M.T.S.E. Curriculum

Required courses

ECE 407 Introduction to Computer Networks with Laboratory **OR**
ECE 408 Introduction to Computer Networks **AND/OR**
ECE 545 Advanced Computer Networks
ECE 513 Communication Engineering Fundamentals
ECE 541 Performance Evaluation of Computer Networks **AND/OR**
ECE 542 Design and Optimization of Computer Networks
CS 586 Software Systems Architecture
CS 587 Programming Project Management

Elective categories

I. Software Engineering

CS 521 Object-Oriented Analysis and Design
CS 537 Software Metrics
CS 589 Software Testing and Analysis

II. Telecommunication Systems

ECE 543 Computer Network Security
ECE 544 Wireless and Mobile Networks
ECE 546 Wireless Network Security
CS 544 Computer Networks II: Network Services
CS 548 Broadband Networks
CS 555 Analytic Models and Simulation of Computer Systems

III. Telecommunications

ECE 504 Wireless Communication System Design
ECE 514 Digital Communication Principles
ECE 515 Modern Digital Communications
ECE 519 Coding for Reliable Communications

The remaining nine credit hours of coursework may be taken from courses listed above, or other courses approved by the M.T.S.E. advisor. Students without a background in communications or software engineering should consider including in their program of studies:

ECE 403 Communication Systems
CS 487 Software Engineering I
CS 450 Operating Systems I
CS 455 Data Communications

Other courses that students in this program typically choose from include:

ECE 437 Digital Signal Processing I
ECE 508 Signal and Data Compression
ECE 511 Analysis of Random Signals
ECE 515 Modern Digital Communications
ECE 565 Computer Vision and Image Processing
ECE 568 Digital Speech Processing
ECE 569 Digital Signal Processing II
ECE 584 VLSI Architectures for Signal Processing and Communications
CS 588 Advanced Software Engineering Development

With advisor approval, the M.T.S.E. program of studies can include up to two credit hours of Masters Seminar (ECE 595, ECE 596). It can also include up to four credit hours of ECE short courses.

Master of Electricity Markets

30 credit hours

Deregulation is bringing major changes to the electric power industry. Electricity is now traded in commodity markets, and these new markets affect the way the electric power grid is controlled and operated. Electrical engineers need to understand both the technical and the business sides of these changes in order to address the needs of the electric power industry.

IIT's Department of Electrical and Computer Engineering and Center for Financial Markets have teamed up to develop new masters degree and graduate certificate programs in electricity markets. Combining existing and new courses from the graduate programs in electrical engineering and in financial markets and trading, the programs provide graduate-level education in electricity markets suitable for electric power engineers. The program of study includes a minimum of 30 credit hours of acceptable graduate coursework, with a minimum of 18 credit hours at the 500 level or higher. Up to two credits of Master's Seminar (ECE 595 or ECE 596) and up to six credits of accelerated courses may be applied to the degree. A background in finance is not required.

Curriculum

Core courses

ECE 555 Power Market Operations
ECE 561 Deregulated Power Systems
ECE 562 Power System Transaction Management
ECE 564 Control and Operation of Electric Power Systems
FM 553 Valuing Energy Derivatives
FM 552 Introduction to Energy Markets

Select two additional courses from the following:

ECE 417 Power Distribution Engineering
ECE 419 Power System Analysis with Laboratory

OR

ECE 418 Power Systems Analysis
ECE 420 Advanced Power System Analysis
ECE 550 Power Electronic Dynamics and Control
ECE 553 Power Systems Planning
ECE 554 Power Systems Relaying
ECE 556 Power Market Economics and Security
ECE 557 Fault-Tolerant Power Systems
ECE 558 Power System Reliability
ECE 559 High Voltage Power System Relaying
ECE 560 Power Systems Dynamics and Stability
ECE 563 Computational Intelligence in Engineering
ECE 531 Linear System Theory
ECE 580 Elements of Sustainable Energy
ECE 581 Elements of Smart Grid

Six additional credit hours of electives are chosen from the offerings of the Department of Electrical and Computer Engineering, including the list of power courses above.

Doctor of Philosophy in Electrical Engineering

84 credit hours, including master's degree studies
Qualifying exam
Comprehensive exam (dissertation proposal defense)
Dissertation
Oral dissertation defense

The doctorate degree in electrical engineering is awarded in recognition of mastery in the field of electrical engineering and upon demonstration of an ability to make substantial creative contributions to knowledge in that field. The Ph.D. recipient will be capable of a continuing effort toward the advancement of knowledge and achievement in research and other scholarly activities. This program is appropriate for those students with master's degrees who are interested in pursuing an academic or industrial research career.

The Ph.D. program requires a minimum of 84 credit hours beyond the bachelor's degree, including the master's degree studies. A minimum of 24 credits are devoted to the students research work, and a minimum of 24 credits are devoted to coursework in electrical and computer engineering and in such basic sciences as mathematics and physics. The selection of courses is considered and approved by the student's advisor and the department's graduate program director on the basis of relevance of course content, rather than along a predetermined sequence announced by the department. Work toward the Ph.D. generally takes a minimum of three years of study beyond the master's degree. Upon admission to graduate study leading to the Ph.D. degree, each student is assigned an academic advisor, who may eventually serve as the thesis advisor and guides the students research.

The department requires a qualifying examination within the first three semesters of full-time Ph.D. studies. This is a written examination consisting of several areas in electrical and computer engineering. This examination is intended to explore both the depth and breadth of the student's academic abilities. At an early stage in the students research program, and usually about a year after passing the qualifying examination, a comprehensive examination is held in the area of specialization.

The comprehensive examination takes the form of an oral presentation and defense of a thesis research proposal. At this time a thesis committee is appointed by the graduate program director, in consultation with the thesis advisor, to guide the remainder of the program. A written dissertation, oral defense and publication requirement constitute completion of the Ph.D. degree. The defense takes place no earlier than one year after passing the comprehensive examination. Dissertation format and deadlines are established by the Graduate College.

Doctor of Philosophy in Computer Engineering

84 credit hours, including master's degree studies
Qualifying exam
Comprehensive exam (dissertation proposal defense)
Dissertation
Oral dissertation defense

The doctorate degree in computer engineering is awarded in recognition of mastery in the field of computer engineering and upon demonstrating the ability to make fundamental contributions to knowledge in that field. The Ph.D. recipient will be capable of making a continuing effort toward the advancement of knowledge and achievement in research and other scholarly activities. This program is appropriate for those students with a master's degree in computer and/or electrical engineering who are interested in pursuing an academic or industrial research career.

The Ph.D. program requires a minimum of 84 credit hours beyond the bachelor's degree, including the master's degree studies. A minimum of 24 credits are devoted to the student's research work, and a minimum of 24 credits are devoted to course work in computer and electrical engineering and in basic sciences, such as computers, mathematics, and physics. The selection of courses is considered and approved by the students advisor and the department's graduate program director on the basis of relevance of course content, rather than along a predetermined sequence announced by the department. Generally, it takes a minimum of three years of study beyond the masters degree to obtain a Ph.D.

Upon admission to graduate study leading to the Ph.D. degree, each student is assigned an academic advisor, who many eventually serve as the thesis advisor and guide the student's research. The department requires a qualifying examination within the first three semesters of full-time Ph.D. study. This is a written examination consisting covering topics in the area of digital and computer systems and at least one minor area in the field of electrical engineering. This examination is intended to explore both the depth and breadth of the student's academic abilities. At an early stage in the student's research program, and usually about a year after passing the qualifying examination, a comprehensive examination is held in the area of digital and computer systems. The comprehensive examination takes the form of a defense of a thesis research proposal. At this time a thesis committee is appointed by the graduate program director, in consultation with the thesis advisor, to guide the remainder of the program. A written dissertation, oral defense, and publication requirement constitute completion of the Ph.D. degree. The defense takes place no earlier than one year after passing the comprehensive examination. Dissertation format and deadlines are established by the Graduate College.

Certificate Programs

Certificate programs provide a student with post baccalaureate knowledge in an area of specialization within electrical and computer engineering. Students in these programs register as certificate non-degree seeking students. Certificates are granted upon completion of all course requirements in the chosen specialization area, as listed below with a minimum GPA of 3.0. Certificate programs must be completed within five years.

It is the student's responsibility to meet all course prerequisites. Any student admitted to a masters degree program offered by the department may apply coursework completed in the certificate program toward the masters degree requirements

Advanced Electronics

This program is composed entirely of elective courses and provides advanced study in electronic design and device theory for those who wish to enhance their analog and digital design skills, while increasing their knowledge of the underlying device physics. A maximum of two 400 level courses may be taken.

Elective courses

(Four from the following)

ECE 411 Power Electronics
ECE 412 Electric Motor Drives
ECE 425 Analysis and Design of Integrated Circuits
ECE 521 Quantum Electronics
ECE 524 Electronic Circuit Design
ECE 525 RF Integrated Circuit Design
ECE 526 Active Filter Design
ECE 527 Performance Analysis of RF Integrated Circuits
ECE 529 Advanced VLSI Design
ECE 530 High Performance VLSI/IC Systems
ECE 571 Nanodevices and Technology
ECE 575 Electron Devices

Applied Electromagnetics

In this certificate program, students receive advanced preparation for careers in electromagnetic engineering, particularly in areas of RF circuits and systems, electromagnetic wave propagation, antenna theory, and electromagnetic compatibility.

Required courses

ECE 421 Microwaves Circuits and Systems
OR
ECE 423 Microwave Circuits and Systems with Laboratory
ECE 509 Electromagnetic Theory

Elective courses

(Two from the following)

ECE 522 Electromagnetic Compatibility
ECE 571 Nanodevices and Technology
ECE 576 Antenna Theory
ECE 578 Microwave Theory

Communication Systems

For those who want to become proficient in communication system principles and applications, this certificate program contains two fundamental courses and a large number of elective courses for emphasis in data compression, computer networks, and analog/digital communications. No more than one course may be a 400-level course.

Required courses

ECE 511 Analysis of Random Signals
ECE 513 Communication Engineering Fundamentals

Elective courses

(Two from the following)

ECE 403 Digital and Data Communication Systems **OR**
ECE 405 Digital and Data Communication Systems with Laboratory
ECE 514 Digital Communication Principles
ECE 515 Modern Digital Communications
ECE 519 Coding for Reliable Communications
ECE 541 Performance Evaluation of Computer Networks
ECE 542 Design and Optimization of Computer Networks
ECE 543 Computer Network Security
ECE 544 Wireless and Mobile Networks
ECE 545 Advanced Computer Networks
ECE 546 Wireless Network Security

Computer Engineering

Graduates of this program gain proficiency in one of several areas, including VLSI design, computer networks, computer hardware and software design. A maximum of one 400-level course may be taken, including ECE 429 if selected as a required course.

Required courses

ECE 429 Introduction to VLSI Design **AND/OR**
ECE 529 Advanced VLSI Systems Design
AND
ECE 585 Advanced Computer Architecture

Elective courses

(Two from the following)

ECE 441 Microcomputers
ECE 446 Advanced Logic Design
ECE 448 Computer Systems Programming
ECE 449 Object-Oriented Programming and Computer Simulation
ECE 485 Computer Organization and Design
ECE 530 High Performance VLSI/IC Systems
ECE 541 Performance Evaluation of Computer Networks
ECE 542 Design and Optimization of Computer Networks
ECE 543 Computer Network Security
ECE 544 Wireless and Mobile Networks
ECE 546 Wireless Network Security
ECE 545 Advanced Computer Networks
ECE 583 High Speed Computer Arithmetic
ECE 584 VLSI Architectures for Signal Processing and Communications
ECE 586 Fault Detection in Digital Circuits
ECE 587 Hardware/Software Codesign
ECE 588 CAD Techniques for VLSI Design
ECE 589 Computer-Aided Design of Analog IC

Control Systems

Engineers who deal with the control and optimization of systems will benefit from the focused coursework in this program, providing intensive studies in linear and non-linear systems, optimized control, controllability and stability of systems, and analysis and synthesis of control systems.

Required courses

ECE 531 Linear System Theory
ECE 535 Discrete Time Control Systems

Elective courses

(Two from the following)

ECE 438 Control Systems **OR**
ECE 506 Analysis of Nonlinear Systems
ECE 550 Power Electronic Dynamics and Control

Electricity Markets

This program is an introduction to both the technical and business sides of a deregulated electric power industry.

Required courses

ECE 561 Deregulated Power Systems
FMT 540 Valuing and Managing Energy Derivatives
FMT 542 Introduction to Energy Markets

Two ECE accelerated courses

Power Electronics

In this certificate program, students receive professional preparation in the areas of power electronic converters, industrial electronics, switching power supplies, electric/electronic motor drives, and electric power quality. This certificate program would be useful to managers, engineers, and students who are seeking a position in power electronics related industry.

Required courses

(Choose at least two)

ECE 550 Power Electronic Dynamics and Control
ECE 551 Advanced Power Electronics
ECE 552 Adjustable Speed Drives
ECE 411 Power Electronics **OR**
ECE 412 Electric Motor Drives

Elective areas

I. Power area

ECE 548 Energy Harvesting
ECE 561 Deregulated Power Systems
ECE 563 Computational Intelligence in Engineering
ECE 564 Control and Operation of Electric Power Systems

II. Electronics area

ECE 437 Digital Signal Processing I
ECE 539 Computer Aided Design of Electric Machines
ECE 575 Electron Devices

III. Control area

ECE 438 Control Systems
ECE 531 Linear System Theory
ECE 535 Discrete Time Systems

IV. Special topics area

Accelerated course(s) in power electronics

Power Engineering

This program provides power engineers with a solid foundation in the design and analysis of large-scale power systems and state-of-the-art power conversion systems, including power systems control, power electronics, motor drives, design of fault-tolerant systems, power markets, and fundamentals of power system operation and planning.

Required course

(Choose one)

ECE 411 Power Electronics
ECE 412 Electric Motor Drives
ECE 419 Power Systems Analysis with Laboratory
OR
ECE 418 Power Systems Analysis
ECE 420 Analytical Methods in Power Systems

Elective courses

(Choose three)

ECE 417 Power Distribution Engineering
ECE 538 Renewable Energies
ECE 539 Computer Aided Design of Electric Machines
ECE 540 Reliability Theory and System Implementation
ECE 548 Energy Harvesting
ECE 549 Motion Control Systems Dynamics
ECE 550 Power Electronic Dynamics and Control
ECE 551 Advanced Power Electronics
ECE 552 Adjustable Speed Drives
ECE 553 Power System Planning
ECE 554 Power Systems Relaying
ECE 555 Power Market Operations
ECE 556 Power Market Economics and Security
ECE 557 Fault-Tolerant Power Systems
ECE 558 Power System Reliability
ECE 559 High-Voltage Power Transmission
ECE 560 Power Systems Dynamics and Stability
ECE 561 Deregulated Power Systems
ECE 562 Power System Transaction Management
ECE 563 Computational Intelligence in Engineering
ECE 564 Control and Operation of Electric Power Systems

Signal Processing

Those seeking expertise in the areas of signal and image processing should take this program, which offers a wide range of advanced courses in the areas of digital signal processing, data compression, image and speech processing, and pattern recognition.

Required courses

ECE 511 Analysis of Random Signals
ECE 569 Digital Signal Processing II

Elective courses

(Choose two; no more than one may be a 400-level course.)

ECE 436 Digital Signal Processing I with Laboratory
ECE 437 Digital Signal Processing I
ECE 481 Image Processing
ECE 507 Imaging Theory and Applications
ECE 508 Video Communications
ECE 565 Computer Vision and Image Processing
ECE 566 Statistical Pattern Recognition
ECE 567 Statistical Signal Processing
ECE 568 Digital Speech Processing
ECE 584 VLSI Architectures for Signal Processing and Communications

Wireless Communication Engineering

For communications engineers who want a focused program providing state-of-the-art instruction in the growing field of wireless communications, this program offers fundamental coursework in traditional telecommunications system design as well as computer communication networks.

Required courses

ECE 504 Wireless Communication System Design
ECE 513 Communication Engineering Fundamentals

Elective courses

(Choose two; no more than one may be a 400-level course.)

ECE 403 Digital and Data Communication Systems
ECE 515 Modern Digital Communications
ECE 519 Coding For Reliable Communications
ECE 541 Performance Evaluation of Computer Networks
ECE 544 Wireless and Mobile Networks
ECE 545 Advanced Computer Networks
ECE 546 Wireless Network Security
ECE 576 Antenna Theory

Course Descriptions

Numbers in parentheses indicate class, lab and credit hours, respectively.

ECE 502
Basic Network Theory
Steady-state analysis of linear networks. Introduction to topology and the derivation of mesh, nodal and terminal pair relations using topological concepts with applications to computer-aided analysis of networks. Network interconnections. Indefinite admittance matrix. Prerequisite: B.S.E.E. degree.
(3-0-3)

ECE 504
Wireless Communication Network Design
Fundamentals of wireless communications, with emphasis on the underlying theory, design techniques, and analytical tools. Overview of wireless systems. Characteristics of wireless channels and their capacity limits. Audio, image and video coding standards. Modulation and coding for wireless channels. Diversity and Equalization techniques. Multiuser communications. Spread spectrum techniques. Multicarrier modulation. Wireless systems: Cellular systems: AMPS, TDMA, CDMA, and WCDMA - design, standards, performance studies. Wireless LAN systems (WiFi, WiMAX): design and standards. Prerequisite: ECE 513.
(3-0-3)

ECE 505
Applied Optimization for Engineers
Principles of optimization for practical engineering problems, linear programming, nonlinear unconstrained optimization, nonlinear constrained optimization, dynamic programming. Prerequisite: B.S. degree in engineering, math orscience, or permission of instructor.
(3-0-3)

ECE 506
Analysis of Nonlinear Systems
Graphical and analytical methods, phase plane and singular points, periodic oscillations and limit cycles, forced nonlinear systems, jumps, subharmonics and frequency entrainment; stability analysis using Liapunov, Popov and circle criteria; introduction to describing functions.
(3-0-3)

ECE 507
Imaging Theory and Applications
Image formation methods including optical (photography), tomography, image formation with arrays of sensors, interferometry, and surface imaging. Technologies of image acquisition including digital cameras, radar/sonar, and medical imaging techniques such as magnetic resonance imaging, computed tomography, positron emission tomography, opical iagin, electroencephalograpy, and magnetoencephalography. Throughout the semester, the course will also focus on the reconstruction of images based on the raw data obtained from various imaging techniques.
(3-0-3)

ECE 508
Video Communications
This graduate-level course covers the fundamentals of video coding and communications. The principles of source coding for the efficient storage and transmission of video will be covered. State-of-the-art video coding standards and error-resilient video coding techniques will be introduced. Recent technologies for robust transmission of video data over wired/wireless networks will be discussed. A detailed overview of arcitectural requirements for supporting video communications will be presented. Error control and cross-layer optimization techniques for wireless communications will be covered.
(3-0-3)

ECE 509
Electromagnetic Field Theory
Electric and magnetic fields produced by charge and current distributions. Solution of Laplaces and Poisson s equations, time-varying fields and electromagnetic waves. Applications to waveguides and antennas. Prerequisite: ECE 307.
(3-0-3)

ECE 511
Analysis of Random Signals
Probability theory, including discrete and continuous random variables, functions and transformations of random variables. Random processes, including correlation and spectral analysis, the Gaussian process and the response of linear systems to random processes. Prerequisites: ECE 308 and MATH 474.
(3-0-3)

ECE 513
Communication Engineering Fundamentals
Review of probability and random processes. AM with noise, FM with noise. Introduction to digital communication. Source coding, signal space analysis, channel modulations, optimum receiver design, channel encoding. Prerequisites: ECE 403 and MATH 474.
(3-0-3)

ECE 514
Digital Communication Principles
Information transmission fundamentals, including capacity, entropy, Shannons theorems and source coding. Introduction to rate distortion theory. Advanced digital modulation and demodulation techniques, performance measures. Carrier and symbol synchronization. Signal design for band-limited channels. Prerequisites: ECE 511, ECE 513.
(3-0-3)

ECE 515
Modern Digital Communication
Review of modulation and coding. Trellis coded modulation. Digital signaling over fading multipath channels. Spread spectrum signals for digital communications. Multichannel and multicarrier signals for digital communications. Multiuser communications, time-division multiple access, code-division multiple access, frequency-division multiple access. Advanced communications systems. Prerequisite: ECE 511, ECE 513.
(3-0-3)

ECE 519
Coding for Reliable Communications
Encoders and decoders for reliable transmission of digital data over noisy channels. Linear block codes, cyclic codes, BCH codes, convolutional codes. Burst error correcting codes. Maximum likelihood decoding of convolutional codes. Performance of block and convolutional codes in additive white Gaussian channel. Turbo codes and low density parity check codes. Prerequisite: MATH 474.
(3-0-3)

ECE 521
Quantum Electronics
The Schrodinger equation. Matrix formulation. Quantization of lattice vibrations and electromagnetic fields. Optical beams and resonators. The interaction of radiation and atomic systems. Lasers. Optical waveguides and devices. Frequency conversion. Quantum noise. Same as PHYS 521. Prerequisite: ECE 307.
(3-0-3)

ECE 522
Electromagnetic Compatibility
Development of design procedures for minimizing interference between electronic circuits and systems. sources of conducted and radiated interference. Interference coupling mechanisms. Shielding theory. Grounding, bonding and filtering methods. special equipment design procedures. Problems associated with digital equipment. Measurement methods. Prerequisite: ECE 307 or equivalent.
(3-0-3)

ECE 524
Advanced Electronic Circuit Design
RF amplifiers and oscillators. Low and high power RF amplifier design techniques. Stability of amplifiers. LC and crystal oscillators. FM demodulators and limiters. Mixer design. Circuit design to minimize intermodulation and other forms of distortion. Prerequisites: ECE 307, ECE 312.
(3-0-3)

ECE 525
RF Integrated Circuit Design
Essentials of contemporary RF CMOS integrated circuit analysis and design. Typical RF building blocks in CMOS and BiCMOS technologies, including passive IC components, MOS transistors, RLC tanks, distributed networks, RF amplifiers, voltage reference and biasing circuits, LNA, mixers, power amplifiers, and feedback networks. RF device modeling, Smith chart, bandwidth estimation and stability analysis techniques. RF IFC team design projects. Prerequisites: ECE 312 and senior or graduate standing.
(3-0-3)

ECE 526
Active Filter Design
Analysis and design of linear active filters with emphasis on realizations using operational amplifiers. Sensitivity analysis. Switched capacitor filters. Prerequisites: ECE 308, ECE 312.
(3-0-3)

ECE 527
Performance Analysis of RF Integrated Circuits
Essentials of analysis techniques for nonlinear effects and noises in contemporary RF integrated circuit design. Nonlinear and distortion behaviors including inter-modulation, cross-modulation, harmonics, gain compression, desensitization, spurious, etc. Noise effects including thermal, short, Flicker, burst noises, etc. RF IC devices and circuits including resistors, capacitors, inductors, diodes, BJTs, FETs, low-noise amplifiers, mixers, power amplifiers, etc. Analysis skills for single-stage and multiple-stage networks. RF IC team design projects. Prerequisites: ECE 312, Senior or Graduate student standing.
(3-0-3)

ECE 529
Advanced VLSI Systems Design
Advanced design and application in VLSI Systems. The topics of this course include design tools and techniques, clocking issues, complexity management, layout and floorplanning, array structures, testing and testability, advanced arithmetic circuitry, transcendental function approximations, architectural issues, signal processing architectures, submicron design. Design project are completed and fabricated by student teams. Prerequisites: Graduate standing and ECE 429.
(3-0-3)

ECE 530
High Performance VLSI/IC Systems
Background and insight into some of the most active performance-related research areas of the field is provided. Issues covered include CMOS delay and modeling, timing and signal delay analysis, low power CMOS design and analysis, optimal transistor sizing and buffer tapering, pipelining and register allocation, synchronization and clock distribution, retiming, interconnect delay, dynamic CMOS design techniques, asynchronous vs. synchronous tradeoffs, BiCMOS, low power design, and CMOS power dissipation. Historical, primary, and recent papers in the field of high-performance VLSI digital and analog design and analysis are reviewed and discussed. Each student is expected to participate in the class discussions and also lead the discussion surveying a particular topic. Prerequisites: Graduate standing and ECE 429.
(3-0-3)

ECE 531
Linear System Theory
Linear spaces and operators, single and multivariable continuous dynamical systems, controllability and observability. Canonical forms, irreducible realizations. Synthesis of compensators and observers. Composite systems, elements of stability. Prerequisite: ECE 308.
(3-0-3)

ECE 535
Discrete Time Systems
Discrete systems. Sampling and reconstruction procedures.Transform techniques of analysis andsynthesis. State space techniques. Discrete controllability, observability and stability.Compensation and digital controllers. Prerequisite: ECE 438.
(3-0-3)

ECE 538
Renewable Energies
Various renewable energy sources such as solar systems, wind powered systems, ocean tides, ocean waves, and ocean thermal are presented. Their operational principles are addressed. Grid connected interfaces for such systems are explained. Research and simulation mini-projects with emphasis on either machine design, or power electronic circuit analysis, design, and controls, or grid connected renewable systems are assigned to student groups.
(3-0-3)

ECE 539
Computer Aided Design of Electric Machines
Fundamentals of energy conversion will be discussed, which are the foundation of efficient design and operation of motors and generators in modern day automotive, domestic, and renewable energy systems. It will further investigate the principles of structural assessment, electromagnetic analysis, dimensional, and thermal constraints. Finite Element Analyis (FEA) software-based design projects will be used to model the performance and operation of electric machines.
(3-0-3)

ECE 540
Reliability Theory and System Implementation
Basic probability and modeling techniques on component, subsystem and system levels. MTBF, MTTR and downtime. Hardware, software and cost considerations. Switching systems. Multicomputer and memory configurations. Prerequisites: ECE 308 and MATH 474.
(3-0-3)

ECE 541
Performance Evaluation of Computer Networks
Introduction to performance evaluation techniques for computer and communication networks. Little s theorem, birth-death processes, M/G/1 queue, product form queueing networks, approximation techniques for G/G/1 queues and non-product form queueing networks. Discrete event simulations, generation of random variables, variance reduction techniques and general purpose simulation languages. Prerequisite: MATH 474.
(3-0-3)

ECE 542
Design and Optimization of Computer Networks
This course provides comprehensive introduction to network flows with an integrative view of theory, algorithms, and applications. It covers shortest path, maximum flow, and minimum cost flow problems, including a description of new and novel polynomial-time algorithms. It also covers topics from basic network design to protection and restoration design, to multi-layer network design while taking into account routing and flow requirement as applicable in different network architecture, protocol and technologies. Prerequisite: ECE 407.
(3-0-3)

ECE 543
Computer Network Security
This course introduces network security by covering topics such as network-related security threats and solutions, private- and public-key encryptions, authentication, digital signatures, Internet Protocol security architecture (IPSEC), firewalls, network management, email and web security. Prerequisite: ECE 407 .
(3-0-3)

ECE 544
Wireless and Mobile Networks
This course provides an overview of different wireless and mobile network standards and systems. The topics covered include cellular networks, satellite networks, wireless local area networks, wireless personal area networks, mobile IP, ad hoc networks, sensor networks, wireless mesh network and wireless network security. Prerequisites: Graduate standing, ECE 407 or ECE 408.
(3-0-3)

ECE 545
Advanced Computer Networks
Fundamentals of computer communication networks. Overview of data communication networks and protocol architectures with emphasis on the Internet protocols and network elements. Principles of network and protocol design; error detection and correction, flow control and congestion control, delay and throughput models, QoS, service support and application interface (including remote procedure call mechanisms). Local and Wide Area Networks (Ethernet, FDDI, Wireless LAN, ATM and Internet). LAN and WAN interconnection using bridges, routers, switchers and gateways. Routing in data networks. Network and protocol design to support multimedia and multicasting connections. Network application security. Prerequisite: ECE 407 or ECE 408.
(3-0-3)

ECE 546
Wireless Network Security
This course focuses on selected research topics in current interests in wireless network security. This course will cover security and privacy issues in wireless systems, including cellular networks, wireless LAN, mobile and ad-hoc networks (MANET), wireless mesh networks, sensor networks, vehicular networks, RFID, and ubiquitous computing.
(3-0-3)

ECE 548
Energy Harvesting
Various harvesting techniques such as solar, ocean ides, vibration, linear motion, radio frequency, passive and active human power generation are presented. Their operational principles are addressed. Research and simulations mini-projects with emphasis on power electronic circuit analysis, design, and controls are assigned to student groups. Prerequisite: ECE 311.
(3-0-3)

ECE 549
Motion Control Systems Dynamics
Fundamentals and applications of motion control systems, control techniques for high precision motion control, state variable feedback of linear and nonlinear systems, multivariable systems, physical system modeling, graphical analysis, and numerical analysis, and system performance analysis. Prerequisites: ECE 438 or permission of instructor.
(3-0-3)

ECE 550
Power Electronics Dynamics and Control
Modeling and analysis of solid-state switching circuits, parallel module dynamics, multi-converter interactions, resonant converters, feedback control, stability assessment, reduced parts converters, integrated structures, programmable switching regulators, digital switch-mode controllers, and power electronic converter-on-a-chip development. Prerequisite: ECE 411.
(3-0-3)

ECE 551
Advanced Power Electronics
Advanced power electronic converters, techniques to model and control switching circuits, resonant converters, multi-level converters, Pulse-Width-Modulation (PWM) techniques, soft switching methods, and low-voltage high-current design issues are studied. Single-phase and multi-phase, controlled and uncontrolled rectifiers and inverters with different operating techniques and their design and control issues are explained. Prerequisite: ECE 411.
(3-0-3)

ECE 552
Adjustable Speed Drives
Fundamentals of electric machines, basic principles of variable speed controls, field orientation theory, direct torque control, vector control of AC drives, induction machines, switched reluctance and synchronous reluctance motors, permanent magnet brushless DC drives, converter topologies of DC and AC drives, and sensorless operation. Prerequisite: ECE 411.
(3-0-3)

ECE 553
Power System Planning
Model development. Interchange capability, interconnections, pooling. Economic generator size and site selection. Concept of reserves, transformers, relays and circuit breakers. Reactive planning AC and DC systems are explored thoroughly from a planning standpoint. Prerequisite: ECE 418 or ECE 419.
(3-0-3)

ECE 554
Power System Relaying
Principles of relay protection for faults on transmission lines and in transformers, rotating machines and other equipment. Use of overcurrent, differential, distance, wire-pilot, carrier-pilot and microwave-pilot relaying systems. Solid-state relays and computer control of relaying. Determination of short-circuit currents and voltages from system studies. Prerequisite: ECE 418 or ECE 419.
(3-0-3)

ECE 555
Power Market Operations
Market design in restructured power systems, artificial neural network applications to power systems, shortterm load forecasting, electricity price forecasting, price-based unit commitment, arbitrage in electricity market, gaming and market monitoring, asset valuation and risk analysis, security-constrained unit commitment, ancillary services auction, transmission pricing and regional transmission organizations. Prerequisite: ECE 418 or ECE 419
(3-0-3)

ECE 556
Power Markets Economics and Safety
This course covers simulation and scheduling tools used in restructured power system for studying the economics and security of power systems. Topics include modeling of generating units (thermal units, combined-cycle units, fuel-switching/blending units, hydro units, pumped-storage units, photovoltaic, wind), Lagrangian Relaxation-based scheduling, mixed integer programming-based scheduling, and Benders decomposition-based transmission security analyses. The simulation and scheduling tools consider different time scales including on-line security, day-ahead, operational planning, and long-term. The simulation and scheduling tools consider interdependency of supply (such as gas, water, renewable sources of energy) and electricity systems. Prerequisites: ECE 420 or consent of instructor.
(3-0-3)

ECE 557
Fault Tolerant Power Systems
Critical fault events in a large power system, sparsity techniques. Contingency screening process. Modeling of local controls in load flow. Adaptive localization method. Injection outage analysis. Security constrained dispatch. LP-based OPF. Real-time security analysis. Dynamic security analysis. Prerequisite: ECE 418 or ECE 419.
(3-0-3)

ECE 558
Power System Reliability
The concept of reliability, reliability indices, component reliability, generation capacity reserve evaluation, transmission system reliability, bulk power system reliability, distributed system reliability, reliability modeling in context. Prerequisite: ECE 418 or ECE 419.
(3-0-3)

ECE 559
High Voltage Power Transmission
Detailed analysis of transmission and distribution systems. Design of high voltage transmission lines and cables, as well as distribution lines. Flexible AC Transmission Systems (FACTS) and high voltage DC links. Prerequisite: ECE 418 or ECE 419.
(3-0-3)

ECE 560
Power System Dynamics and Stability
The transient stability problem, acceleration equations, stability criteria, two-machine and multi-machine problems. Perturbation analysis, eigenvalue sensitivity, Liapunov theory and application to power systems stability. Prerequisite: ECE 418 or ECE 419.
(3-0-3)

ECE 561
Deregulated Power Systems
Overview of key issues in electric utilities restructuring, Poolco model, bilateral contracts, market power, stranded costs, transmission pricing, electric utility markets in the United States and abroad, OASIS, tagging electricity transactions, electric energy trading, risk in electricity markets, hedging tools for managing risks, electricity pricing, volatility in power markets, RTO. Prerequisite: ECE 418 or ECE 419.
(3-0-3)

ECE 562
Power System Transaction Management
Power interchange transaction management in the deregulated electric power industry. Course topics include power system security assessment, total and available transfer capability (TTC/ATC), transaction management system (TMS), transaction information system (TIS), tagging, interchange distribution calculator (IDC), congestion management, transmission loading relief (TLR). Prerequisite: ECE 418 or ECE 419.
(3-0-3)

ECE 563
Computational Intelligence in Engineering
Introduction to soft computing, fuzzy set theory, neural networks, genetic algorithms, intelligent software agents, comparisons with traditional alternatives, advanced engineering applications. Prerequisite: Graduate standing.
(3-0-3)

ECE 564
Control and Operation of Power Systems
Unit commitment and application of dynamic programming, fuel budgeting and planning, probabilistic production cost modeling, hydrothermal coordination, power system security and application of expert systems, state estimation, optimal power flow, interchange evaluation and power pools, reactive power planning. Prerequisite: ECE 418 or ECE 419.
(3-0-3)

ECE 565
Computer Vision and Image Processing
Multi-dimensional signal sampling and discrete Fourier transform; Image segmentation; Object boundary (edge) detection and description; Shape representation and extraction; Matching and recognition; Image registration; Camera geometry and stereo imaging; Morphological processing; Motion detection and compensation; Image modeling and transforms; Inverse problems in image processing (restoration and reconstruction). Prerequisite: ECE 437 and MATH 474.
(3-0-3)

ECE 566
Statistical Pattern Recognition
Review of appropriate math: multidimensional probability, covariance matrices, whitening transformation, diagonalization, eigenvectors, eigenvalues. Two-class and multi-class pattern separation using maximum likelihood and MAP. Linear discriminant analysis. Perception algorithm and its extensions. Feature extraction algorithms. Clustering algorithms. Introduction to neural nets. Hopfield, Hamming, feedforward models. Training of neural nets. Prerequisite: ECE 511.
(3-0-3)

ECE 567
Statistical Signal Processing
Detection theory and hypothesis testing. Introduction to estimation theory. Properties of estimators, Gauss-Markov theorem. Estimation of random variables: conditional mean estimates, linear minimum mean-square estimation, orthogonality principle, Wiener and Kalman filters. Adaptive filtering. LMS algorithm: properties and applications. Prerequisites: ECE 511, MATH 333.
(3-0-3)

ECE 568
Digital Speech Processing
Review of discrete statistical signal analysis. Acoustic aspects of speech and hearing. Digital models of speech production. Short-time processing in time and frequency domains. Waveform encoding and linear predictive coding of speech. Estimation of fundamental speech parameters. Applications including automatic speech recognition and enhancement. Prerequisites: ECE 437, ECE 511.
(3-0-3)

ECE 569
Digital Signal Processing II
Review of basic DSP theory. Design of digital filters: FIR, IIR, frequencytransformation methods, optimal methods. Discrete Fourier Transform (DFT) and Fast Fourier Transform algorithms. Spectral estimation techniques, classical and parametric techniques. AR, MA, ARMA models. Estimation algorithms. Levinson, Durbin-Levinson and Burg s algorithms. Eigenanalysis algorithms for spectral estimation. Prerequisites: ECE 437 and MATH 474.
(3-0-3)

ECE 570
FIber Optic Communication Systems
Physics of optical fiber, composition, dimensioning, coupling, attenuation, dispersion. Electro-optical conversion devices (ILDs, LEDs, APDs, PINs). Circuit considerations. Modulation techniques and implications. Overall system considerations. Coherent techniques. Prerequisites: ECE 307, ECE 309, ECE 312, ECE 403.
(3-0-3)

ECE 571
Nanodevices and Technology
Electronic properties and quantum effects; Dielectric, magnetic and optical properties and their characterizations; Individual nanoparticles and clusters; Carbon nanotubes; Solid disordered nanostructures; Nanostructured crystals; Quantum wells, wires and dots; Giant magnetoresistance; Material processing techniques; Devices and systems based on nanostructures. Prerequisites: B.S. degree with knowledge of quantum mechanics and thermodynamics.
(3-0-3)

ECE 575
Electron Devices
Electronic properties of solids. Properties of p-n junctions and junction devices. Gunn diode and IMPATT devices. Junction transistors. Schottky diode and MESFET. The MOS capacitor and MOSFET. Lightemitting diodes and junction lasers. Velocity modulation and bunching in electron beams. Klystrons, magnetrons and other microwave thermionic devices. Prerequisites: ECE 307, ECE 312.
(3-0-3)

ECE 576
Antenna Theory
Plane and spherical waves. Electric and magnetic dipoles. Radiation patterns and impedance characteristics of antennas in free space and over perfect ground. Linear and planar driven antenna arrays. Yagi-Uda parasitic arrays. Prerequisites: ECE 307, ECE 421 or ECE 423.
(3-0-3)

ECE 578
Microwave Theory
Microwave field theory. Propagation, reflection and refraction of plane waves. Anisotropic media. Impedance concept. Hollow, surface-wave and dielectric wave guides. Discontinuities in wave guides. Microwave resonators. Transmission lines. Microwave circuit theory. Prerequisite: ECE 421 or ECE 423.
(3-0-3)

ECE 580
Elements of Sustainable Energy
This course covers cross-disciplinary subjects on sustainable energy that relate to energy generation, transmission, distribution, and delivery, as well as theories, technologies, design, policies, and integration of sustainable energy. Topics include wind energy, solar energy, biomass, hydro, nuclear energy, and ocean energy. Focus will be on the integration of sustainable energy into the electric power grid, the impact of sustainable energy on electricity market operation, and the environmental impact of sustainable energy.
(3-0-3)

ECE 581
Elements of Smart Grid
This course covers cross-disciplinary subjects on smart grids that relate to enregy generation, transmission, distribution, and delivery, as well as theories, technologies, design, policies, and implementation of smart grid. Topics include: smart sensing, communication, and control in energy systems; advanced metering infrastructure; energy management in buildings and home automation; smart grid applications to plug-in vehicles and low-carbon transportation alternatives; cyber and physical security systems; microgrids and distributed energy resources; demand response and real-time pricing; and intelligent and outage management systems.
(3-0-3)

ECE 583
High Speed Computer Arithmetic
This course covers computer arithmetic as applied to general-purpose and application-specific processors. The focus is on developing highspeed arithmetic algorithms and understanding their implementation in VLSI technology. Topics include fixed and floating point number systems, algorithms and implementations for addition, subtraction, multiplication, division, and square root, floating point operations, elementary function approximation, low-power design, error analysis, and interval arithmetic. Prerequisites: ECE 446 or ECE 485.
(3-0-3)

ECE 584
VLSI for Signal Processing and Communications
This course aims to convey knowledge of advanced concepts in VLSI signal processing. Emphasis is on the architectural research, design and optimization of signal processing systems used in telecommunications, compression, encryption and coding applications. Topics covered include the principles of datapath design; FIR and IIR filtering architectures; communication systems including OFDM, multirate signal processing; fast transforms and algorithms including fast Fourier Transform; Discrete Cosine Transform; Walsh-Hadamard Transform; and Wavelet kernels. Furthermore, advanced computer arithmetic methods including Galois Fields, CORDIC, residue number systems, distributed arithmetic, canonic signed digit systems and reduced adder graph algorithms are examined. Prerequisite: ECE 429 and ECE 437.
(3-0-3)

ECE 585
Advanced Computer Architecture
Design, Analysis and Performance of High-Performance Computer Architectures; High Speed memory Systems: Cache Design and Analysis; Modeling Cache Performance; Instruction Level Parallelism, Cacheonly Memory Architectures, Classification of Parallel Architectures; Systolic and Data Flow Architectures; Multiprocessor Performance; and Multiprocessor Interactions. Prerequisite: Graduate standing or faculty consent.
(3-0-3)

ECE 586
Fault Detection in Digital Circuits
Essential elements in testing and testability of digital designs. Automatic test generation algorithms and fault-simulation methods. Design methodologies to increase testability and decrease test generation costs. Techniques for built-in testing. Prerequisite: ECE 446.
(3-0-3)

ECE 587
Hardware and Software Co-Design
Computer-aided techniques for the joint design of hardware and software: specification, analysis, simulation and synthesis. Hardware/software partitioning, distributed system cosynthesis, application-specific instruction set design, interface cosynthesis, timing analysis for real-time systems. Prerequisites: CS 201, ECE 441, graduate standing.
(3-0-3)

ECE 588
CAD Techniques for VLSI Design
Overview of techniques and algorithms used in Computer-Aided Design (CAD) for VLSI circuits. Physical CAD tools, including placement, routing, symbolic layout and compaction. High-level CAD tools, including logic synthesis, silicon compilers and high-level synthesis. Recent developments in the field. Design, implementation and performance analysis of prototype CAD tools. Prerequisite: ECE 429.
(3-0-3)

ECE 589
Computer Aided Design of Analog IC
Analog IC design optimization algorithm such as equation-based optimization and simulation-based optimization algorithms, design automation tools such as harmonic balance, projection-based surface response estimation, shooting methods, etc. will be introduced. Research and mini-projects with emphasis on analog integrated circuit design and optimization algorthms using state-of-the art tools are assigned to student groups. Prerequisite: Graduate standing.
(3-0-3)

ECE 591
Research and Thesis for M.S. Degree

ECE 594
Special Projects

ECE 597
Special Problems

Undergraduate Courses Available to Graduate Students

ECE 401
Communication Electronics

ECE 403
Digital and Data Communication Systems

ECE 405
Digtal and Data Communication Systems with Laboratory

ECE 407
Introduction to Computer Networks with Laboratory

ECE 408
Introduction to Computer Networks

ECE 411
Power Electronics

ECE 412
Electric Motor Drives

ECE 417
Power Distribution Engineering

ECE 418
Power Systems Analysis

ECE 419
Power Systems Analysis with Laboratory

ECE 420
Analytical Methods in Power Systems

ECE 421
Microwaves

ECE 423
Microwave Circuits and Systems

ECE 425
Analysis and Design of Integrated Circuits

ECE 429
Introduction to VLSI Design

ECE 436
Digital Signal Processing with Laboratory

ECE 437
Digital Signal Processing

ECE 438
Control Systems

ECE 441
Microcomputers

ECE 446
Advanced Logic Design

ECE 449
Object-Oriented Programming and Computer Simulation

ECE 481
Image Processing

ECE 485
Computer Organization and Design

Energy/Environment/Economics (E^3)

Faculty Directors

Chemical and Environmental Engineering
Javad Abbasian
127 Perlstein Hall
10 W. 33rd St.
Chicago, IL 60616
312.567.3047
abbasian@iit.edu

Mechanical, Materials and Aerospace Engineering
Herek Clack
252-D Engineering 1
10 W. 32nd St.
Chicago, IL 60616
312.567.3184
clack@iit.edu

Electrical and Computer Engineering
Alexander J. Flueck
319 Siegel Hall
3301 S. Dearborn St.
Chicago, IL 60616
312.567.3625
flueck@iit.edu

Program Coordinator
Bennetta Garrison
127 Perlstein Hall
10 W. 33rd St.
Chicago, IL 60616
312.567.3071
garrison@iit.edu

The ongoing evolution of the energy system and related global, environmental and economic issues make necessary a new interdisciplinary approach to the education of energy-industry engineers and management professionals, as well as to the planning and performance of energy research and development. The petroleum, coal, natural gas, nuclear, renewable and electric utility industries and associated resource and raw material extraction, equipment design and manufacturing, and construction industries, are facing not only technological change and environmental constraints, but also drastic changes in the economic, institutional and trade environments in which they operate.

IIT's Energy/Environment/Economics (E^3) program was developed to respond to the rapidly changing needs of the energy industry by providing the interdisciplinary research and training required to produce a new breed of engineer-one who specializes in energy technologies and who understands the associated environmental issues and economic forces that drive technology choice.

E^3specialization requires an interdisciplinary thesis in an E^3area of research for M.S. and Ph.D. degrees, and an interdisciplinary graduate project for professional masters degrees. Graduate students in E^3should also be enrolled in fundamental courses related to the topics of energy, environment and economics. $E^3$is designed primarily for students majoring in chemical and environmental, mechanical and aerospace, or electrical engineering who are planning careers in energy-related fields. This interdisciplinary training prepares students to be not only creative and expert in a specialized area of energy extraction, conversion or utilization, but also to possess a broad knowledge base of different energy sources, environmental issues related to energy extraction, conversion and utilization, and of the impact of industrial ecology principles on the design and operation of energy systems. Furthermore, students will gain sufficient knowledge of economic and regulatory issues to enable them to make more viable technology choices.

Degrees Offered

Master of Chemical Engineering with E^3specialization
M.S. in Chemical Engineering with E^3specialization
Master of Electrical and Computer Engineering with E^3specialization
M.S. in Electrical Engineering with E^3specialization (thesis and non-thesis options)
Master of Environmental Engineering with E^3specialization
M.S. in Environmental Engineering with E^3specialization
Master of Mechanical and Aerospace Engineering with E^3specialization
M.S. in Mechanical and Aerospace Engineering with E^3specialization
Ph.D. in Chemical Engineering with E^3specialization
Ph.D. in Environmental Engineering with E^3specialization
Ph.D. in Electrical Engineering with E^3specialization
Ph.D. in Mechanical and Aerospace Engineering with E^3specialization

Research Centers and Facilities

Students should consult descriptions in the respective departments:

Chemical and Biological Engineering
Electrical and Computer Engineering
Mechanical, Materials and Aerospace Engineering

Admission Requirements

Students should consult listings in the respective departments:

Chemical and Biological Engineering
Electrical and Computer Engineering
Mechanical, Materials and Aerospace Engineering

General Degree Requirements

Students pursuing a master's degree are required to take 30-32 credit hours beyond the requirements of a B.S. degree program. The Ph.D. program requires 84 credit hours beyond the Bachelor of Science. The curriculum consists of two components: department core courses that provide a strong background in basic principles of the chosen engineering field and E^3specialization courses. The following section details the E^3course requirements for M.S., professional masters, and Ph.D. degrees in chemical engineering, environmental engineering, mechanical and aerospace engineering, and electrical engineering. Selected E^3undergraduate courses may be substituted for graduate courses with the approval of the designated advisor, if the total undergraduate credit hours for the professional masters or M.S. degree do not exceed departmental constraints.

Students are also required to attend interdisciplinary seminars during their first and/or second semesters, which are offered as part of the regular graduate seminars by the departments of Chemical and Biological Engineering; Mechanical, Materials and Aerospace Engineering; and Electrical and Computer Engineering. A student completing an M.S. or Ph.D. thesis or professional masters project will be a member of an interdisciplinary research team consisting of professors and students from chemical, environmental, electrical and mechanical engineering backgrounds, working in a crossdisciplinary group project. Each interdisciplinary team must include professors from different departments.

Policies and procedures regarding admission, advising, financial aid and comprehensive examinations are established by the individual departments offering this program.

Master of Chemical Engineering with E^3 specializaion

32 credit hours
Project

This program has the same requirements as the M.S. degree program, except that, in place of 8 credit hours of M.S. thesis research, students are required to register for 2-5 credits of special projects research (CHE 594), plus additional E^3courses with the approval of their advisor.

Master of Science in Chemical Engineering with E^3 specialization

32 credit hours
Thesis

Students pursuing the M.S. in Chemical Engineering with E^3specialization are required to take CHE 543 and select at least one course from Group A and one course from Group B (listed in the E^3course section of this bulletin), and register for up to 8 credit hours of M.S. thesis preparation (CHE 591) in an interdisciplinary E^3area. In addition, the students are required to take all required core courses for the M.S. in Chemical Engineeering degree.

Students may apply up to 12 credit hours of 400-level courses to the M.S. degree requirements with their advisor's approval.

Master of Environmental Engineering with E^3 specialization

32 credit hours
Project

This program has the same requirements as the M.S. degree program, except that in place of 8 credit hours of M.S. thesis research, students are required to register for 2-5 credits of special project research (ENVE 594), plus additional E^3courses with the approval of their advisor.

Master of Science in Environmental Engineering with E^3 specialization

32 credit hours
Thesis

Candidates for the M.S. in Environmental Engineering with E^3specialization are required to take ENVE 544 and complete the required core courses for the M.S. in Environmental Engineering degree. In addition, students must complete one course from Group A, and one from Group B (listed in the E^3course section of this bulletin).

Students are also required to register for up to eight credit hours of M.S. thesis research (ENVE 591) in an interdisciplinary E^3area. Students may apply up to two 400-level courses to the M.S. degree requirements with their advisor's approval.

Master of Mechanical and Aerospace Engineering with E^3 specialization

30 credit hours

Candidates for the Master of Mechanical and Aerospace Engineering are required to take CHE 543 and the following three courses:

MMAE 501 Engineering Analysis I
MMAE 520 Advanced Thermodynamics
MMAE 523 Fundamentals of Power Generation

In addition, the E^3specialization under MMAE requires a course emphasizing numerical methods, 2 courses selected from the following Group A courses, and one Group B course, in the E3 course section of this bulletin.

MMAE 521 Statistical Thermodynamics
MMAE 524 Fundamentals of Combustion
MMAE 525 Fundamentals of Heat Transfer
MMAE 526 Heat Transfer: Conduction
MMAE 527 Heat Transfer: Convection and Radiation

Master of Science in Mechanical and Aerospace Engineering with E^3 specialization

32 credit hours Thesis

Candidates for the M.S. in Mechanical and Aerospace Engineering with E^3specialization are required to take CHE 543 and two courses: MMAE 501 (Engineering Analysis I) and MMAE 502 (Engineering Analysis II). Also required under the thermal sciences area of MMAE are MMAE 520 (Advanced Thermodynamics), MMAE 523 (Fundamentals of Power Generation) and any two of the following Group A courses:

MMAE 521 Statistical Thermodynamics
MMAE 524 Fundamentals of Combustion
MMAE 525 Fundamentals of Heat Transfer
MMAE 526 Heat Transfer: Conduction
MMAE 527 Heat Transfer: Convection and Radiation

Also required are one course from Group B and six to eight credit hours of MMAE 591 (Thesis).

Master of Electrical and Computer Engineering with E^3 specialization

30 credit hours
Non-thesis option

This program has the same requirements as the M.E.C.E. degree program, except that students are required to register for 3-6 credits of special project research (ECE 594), plus CHE 543, two courses from the electrical engineering courses listed in Group A, one course from Group B (listed in the E^3course section of this bulletin), and two power and control courses. At least 24 ECE credits are required.

Master of Science in Electrical Engineering with E^3 specialization

32 credit hours
Thesis option

Candidates for the M.S. in Electrical Engineering are required to take CHE 543 and must select two courses from the electrical engineering courses listed in Group A (listed in the E^3course section of this bulletin) and one course from Group B. In addition, students are required to take two power and control courses, and at least one course from each of two minor areas of study: communication theory and signal processing, network electronics and electromagnetics, or computer engineering. The students also are required to register for 6-8 credit hours of M.S. thesis research (ECE 591) in an interdisciplinary E^3area and one advanced math course (unless this requirement was met in the B.S. degree). Students may apply up to 12 credit hours of 400-level courses toward the M.S. degree with their advisor's approval.

Doctor of Philosophy with E^3 specialization

84 credit hours
Qualifying exam
Comprehensive exam
Dissertation and oral defense

Students interested in the Ph.D. program in all disciplines (chemical, environmental, mechanical, materials and aerospace, and electrical engineering) are required to take at least 84 credit hours beyond the B.S. degree requirements, including CHE 543 and at least five E^3courses (four from both groups A and B; see course listings within the Electrical and Computer Engineering section of this bulletin) upon the recommendation of their thesis advisor. Registration for approximately 32 hours of Ph.D. thesis research in E^3areas of study is also required. Candidates must pass written qualifying and comprehensive examinations and must defend their thesis in an oral examination. The Ph.D. committee for E^3students must include at least one E^3professor from outside the student's department.

E^3 Courses

See descriptions under the respective department course listings.

Group A

CHE 505
Fluid Properties

CHE 512
Heat Transfer

CHE 518
Mass Transfer

CHE 524
Industrial Catalysis

CHE 536
Computational Techniques in Engineering

CHE 540
Flow Through Porous Media and Fundamentals of Reservoir Engineering

CHE 541
Renewable Energy Technologies

CHE 542
Fluidization and Gas-Solids Flow Systems

CHE 544
Kinetic Theory of Multiphase Flow

CHE 563
Separation Processes

CHE 565
Electrochemical Engineering

CHE 576
Industrial Chemistry: Catalytic and Thermal Reactions and Processes

ECE 550
Power Electronics Dynamics and Control

ECE 551
Advanced Power Electronics

ECE 552
Adjustable Speed Drives

ECE 553
Power Systems Planning

ECE 554
Power Systems Relaying

ECE 555
Market Operations in Electric Power Systems

ECE 557
Fault Tolerant Power Systems

ECE 558
Power Systems Reliability

ECE 559
High Voltage Power Transmission

ECE 560
Power Systems Dynamics and Stability

ECE 561
Deregulated Power Systems

ECE 562
Power System Transaction Management

ECE 563
Computational Intelligence in Engineering

ECE 564
Control and Operation of Electric Power Systems

MMAE 517
Computational Fluid Dynamics

MMAE 520/CHE 503
Advanced Thermodynamics

MMAE 521
Statistical Thermodynamics

MMAE 522
Air Conditioning Analysis

MMAE 523
Fundamentals of Power Generation

MMAE 524
Fundamentals of Combustion

MMAE 525
Fundamentals of Heat Transfer

MMAE 526
Heat Transfer: Conduction

MMAE 527
Heat Transfer: Convection and Radiation

MMAE 538
Computational Techniques in Finite Element Methods

MMAE 539
Nonlinear Finite Element Analysis

Group B

CHE 541
Renewable Energy Technologies

CHE 560
Statistical Quality and Process Control

CHE 587
Particle Processing and Characterization

EM 507
Industrial Ecology

ENVE 501
Environmental Chemistry

ENVE 506
Chemodynamics

ENVE 520
Environmental Monitoring and Assessment

ENVE 527
Statistical Analysis of Systems

ENVE 542
Physicochemical Processes in Environmental Engineering

ENVE 545
Environmental Regulations and Risk Assessment

ENVE 551
Industrial Waste Treatment

ENVE 561
Design of Sanitary Engineering Processes

ENVE 563
Systems Engineering: Waste Facility Design and Operation

ENVE 570
Air Pollution Meteorology

ENVE 571
Air Pollution Engineering

ENVE 577
Design of Air Pollution Control Devices

ENVE 578
Physical and Chemical Processes for Industrial Gas Cleaning

ENVE 580
Hazardous Wastes Engineering

ENVE 585
Groundwater Contamination and Pollutant Transport

Food Safety and Technology

National Center for Food Safety and Technology
IIT Moffett Campus
6502 S. Archer Road
Summit-Argo, IL 60501
708.563.8271
708.563.8274 (fax)
www.iit.edu/ncfst

NCFST Vice President and Director:
Robert Brackett, Ph.D.

NCFST Graduate Program Director:
Jason Wan, Ph.D.

The National Center for Food Safety and Technology (NCFST), with IIT faculty, U.S. Food and Drug Administration (FDA) scientists, and food industry experts, provides a unique training ground for individuals seeking graduate education in food safety and technology and food process engineering. Courses are offered at NCFST with the strong support of the following IIT departments: Biological, Chemical, and Physical Sciences (BCPS) and Chemical and Biological Engineering (ChBE).

The master's degree programs in Food Process Engineering (FPE) are designed as flexible programs to educate food technologists and engineers in aspects relating to food processing and safety. Students can specialize in food processing and packaging, food microbiology and safety, compositional safety of food (chemistry), and foods for health (nutrition). Graduates of the program will be prepared to assume responsible positions in food manufacturing operations, research and development, food safety, compliance and regulatory affairs, and quality assurance in the processing, retail, and food service segments of the food industry. Other career options include positions with federal, state or local health and agri-food agencies, and in policy-making, regulatory, or research roles with organizations associated with food manufacturing operations.

The teaching faculty is drawn from NCFST/IIT faculty and NCFST/FDA scientists, and is augmented by IIT faculty from several departments, together with scientists and experts from the private sector. In addition to the formal course requirements, students may participate in food safety and technology research projects at the NCFST under the supervision of IIT faculty and FDA scientists. The FDA presence provides a unique opportunity for students to understand the synergy of scientific philosophy and legal issues involved in the regulatory process governing the safety and wholesomeness of the food supply.

Degres Offered

Master of Science in Food Safety and Technology (Thesis Option)
Master of Food Safety and Technology (Professional, Non-Thesis Option)
Master of Science Food Process Engineering (Thesis Option)*
Master of Food Process Engineering (Professional, Non-Thesis Option)*

** Please refer to Chemical and Biological Engineering Department*

Certificate Programs

Food Safety and Technology
Food Process Engineering*
Food Processing Specialist*

** Please refer to Chemical and Biological Engineering Department*

Facilities

The NCFST facilities include a 2,692 square meter industrial scale pilot plant. The pilot plant houses state of the art equipment such as computer-controlled retorts, high temperature-short time plate pasteurizer, high pressure food processors for pasteurization and sterilization studies, equipment for aseptic processing of particulate foods, pulsed electric field apparatus, ozone processor, UV food processors, homogenizers, and high power ultrasound. A separate Biosafety Level-3 (BSL-3) Biocontainment Pilot Plant (BCPP) provides an opportunity to conduct studies on control of pathogenic microorganisms using pilot-scale equipment. Further, microbiological, food engineering, chemical and packaging laboratories support the pilot plant facilities. NCFSTs food science and technology library provides both physical and systems access to current and retrospective research and technical publications.

Faculty

Robert E. Brackett, Professor and Vice President and Director, National Center for Food Safety and Technology, B.S., M.S., Ph.D. University of Wisconsin-Madison. Microbiological food safety; growth and survival of psycrotrophic pathogens in foods; physical/chemical controls for pathogens in foods; and microbial ecology of plant products.

Britt Burton-Freeman, Research Assistant Professor of Biology, Director of Nutrition, NCFST IIT. B.S. California State University, Chico, M.S. and Ph.D. University of California, Davis. Appetite and obesity management and vascular disease. Research emphasizes on the effects of bioactive food components on mechanistic and behavioral processes of food intake and body weight regulation. Properties of fibers, micro- and macro-molecule interactions, and food matrix effects in the gut to alter metabolic and endocrine systems. Effects of dietary constituents on vascular diseases including evaluation of endothelium function, platelet activation, inflammatory and oxidative stress responses during acute and chronic interventions. The research approach includes human and basic science methodology.

Jack Cappozzo, Director of Chemistry, NCFST/IIT. M.S., Illinois Institute of Technology. Analytical chemistry with emphasis on separation science using high performance liquid chromatography (HPLC) and gas chromatography (GC) coupled to mass spectrometry (MS). Interest has been on new methods of analysis using HPLC-MS/MS to detect ultra-low levels of vitamins, flavonoids, and other phenolic antioxidants in foods and clinical serum samples to support clinical trials. In addition, core work is also performed in the areas of allergen cleaning and methods.

Indika Edirisinghe, Senior Scientist and Research Assistant Professor, NCFST/IIT, Clinical Nutrition Research Center. Ph.D., University of California at Davis. Effect of polyphenolic compounds on endothelial function, blood pressure regulation, platelet function, insulin resistance, inflammatory and oxidative stress responses during acute and chronic interventions. The research approach includes human cell culture, animal models and human clinical trials.

Kathiravan Krishnamurthy, Engineer and Research Assistant Professor, NCFST/IIT. Ph.D., Pennsylvania State University. Novel food processing technologies for sterilization, pasteurization, and/or value adding; mathematical modeling; high pressure processing; ultrasound applications; non-thermal plasma processing; microwave heating; continuous and pulsed ultraviolet light processing; gamma irradiation; infrared heating; and engineering design, control and optimization.

Alvin Lee, Director of Microbiology and Research Associate Professor. B. App. Sci. (Hons), Ph.D, RMIT University (Australia). Research Interest: Microbial food safety, food virology, molecular detection and quantification of enteric pathogens; molecular characterization of virulence mechanisms, cell culture, intervention strategies for foodborne pathogens.

Jason Wan, Research Professor and Director of Education and International Outreach, NCFST/IIT. B.S., M.S., Ph.D., Deakin University (Australia). Molecular microbiology including development of DNA-based methods for detection, differentiation and tracking of foodborne pathogens in food systems and environment. Emerging nonthermal processing technologies, including high pressure processing (HPP), pulsed electric field (PEF), ultrasound, UV and non-thermal plasma, for microbial inactivation, shelf-life extension and food safety enhancement. Dairy processing, protein chemistry, and development and evaluation of bioactive dairy ingredients for functional food applications.

Darsh Wasan, Professor of Chemical Engineering, Vice President for International Affairs, and Motorola Chair. Ph.D., University of California, Berkeley. Interfacial colloidal phenomena, foams, emulsions and dispersions, and food and environmental technologies.

Wei Zhang, Assistant Professor of Biology, B.En., M.S., Huazhong Agricultural University, (China); Ph.D.,.Pennsylvania State University. Microbial food safety and security; PCR detection and molecular tracking of foodborne pathogens; comparative genomics; study of bacterial pathogenesis, epidemiology, evolution and emergence of new pathotypes; identification of novel bacterial virulence factors; DNA microarray analysis of global gene expressions of foodborne pathogens under environmental or food processing stresses; MALDI-TOF mass spectrometry analysis of bacterial proteomes; applications of DNA fingerprinting technology; development of high-throughput SNP genotyping for foodborne disease surveillance and bioterrorism investigations.

Adjunct Faculty

Rich Schell, Adjunct Professor, Food Law and Regulation, NCFST/IIT. B.A., Illinois Wesleyan University J.D., Southern Illinois University. International food and agriculture; agricultural and food entrepreneurship, including organics and green/sustainability initiatives; food and farm traceability; farmland ownership; legal and regulatory compliance as a competitive advantage for food companies and entrepreneurs.

Admission Requirements

Cumulative undergraduate GPA minimum: 3.0/4.0
1100 for Master of Science Degree (quantitative + verbal) and 2.5 analytical writing
Thesis required
950 for Professional Master (Non-Thesis Option)
TOEFL minimum: 550/213/80*

* Paper-based test score/computer-based test score/internet-based test score.

Program Descriptions

Students in the Food Safety and Technology programs should consult with their faculty advisor to plan a program of study best suited to their background and interests. The Food Safety and Technology program is directed toward students with backgrounds in food science and related fields. The Food Process Engineering (FPE) programs are directed toward students with background and career objectives in engineering-related disciplines. Students enrolled in FST Master of Science programs must register for six to eight credit hours of research. This work will usually be conducted at the Moffett Campus; research topics will be selected from food safety, food process engineering, food biotechnology, or related topics. Attendance will also be required in a graduate seminar where students are expected to actively participate and present reports on their research. Students enrolled in Master of Food Safety and Technology and Master of Food Process Engineering are strongly encouraged to do an independent project. Details on food process engineering program requirements are in the section on the Department of Chemical and Biological Engineering.

Master of Science in Food Safety and Technology

Thesis Required

32 credit hours
M.S. Thesis Defense (Written Thesis Report and Oral Defense Required)

Candidates are required to take a total of 32 credit hours, 18 of which must be selected from the core food safety and technology courses listed below, 6-8 credit hours must be in research and thesis work and 6-8 credit hours from electives. Courses are offered at NCFST and via the internet, with the exception of FST 506, FST 593, FST 594, and FST 597.

Core Course Requirements (18 credit hours)

FST 505 Food Microbiology
FST 506 Food Microbiology Laboratory
FST 507 Food Analysis
FST 521 Food Process Engineering
FST 524 Fundamentals of Food Science and Technology
FST 541 Principles of Food Packaging

Core Research Thesis Requirement (6-8 credit hours)

FST 591 Research and Thesis for M.S. Degree

Research for the thesis must be carried out under the direct supervision of a participating faculty member. Based on the requirements of the research project, thesis committee members may be chosen from IIT faculty members from BCPS and various departments, NCFST/FDA scientists and the food industry scientists. The final thesis examination consists of submission of a written thesis followed by an oral presentation open to all NCFST staff and the university community. As a part of the thesis, the student is expected to contribute to one or more high quality peer-reviewed journal article(s). The student is also encouraged to present the research at a national professional society meeting.

Electives (6-8 credit hours)

FST 504 Food Biotechnology
FST 511 Food Law and Regulation
FST 531 HACCP Planning and Implementation
FST 593 Seminar Series
FST 594 Special Projects (dependent upon number of thesis credits taken, please consult NCFST Academic Advisor)
FST 597 Special Problems (dependent upon number of thesis credits taken, please consult NCFST Academic Advisor)

Students may enroll in FST 594 and FST 597 up to a maximum of 2 credit hours between both courses when enrolled in 6 credits of thesis; or 1 credit hour when enrolled in 7 credit hours of thesis. However, if the 597 is used as a short course, the student can register up to 4 credits in 597 with NCFST Advisor approval. Students may not enroll in FST 594 or 597 when using 8 credits of thesis unless 597 is used as a short course (up to 4 credits with NCFST Advisor approval).

Students must have a minimum grade point average of 3.0/4.0. In addition to the core courses required and electives of all students, further courses may be selected from the Biological, Chemical, and Physical Sciences Department (BCPS) and the Chemical and Biological Engineering Department (ChBE) with the approval of the NCFST advisor, to fit the background and needs of the individual student.

Master of Food Safety and Technology

Professional, Non-Thesis Option

32 credit hours

Candidates are required to take a total of 32 credit hours, 15-18 credit hours of which must be selected from the core food safety and technology courses listed below, and 14-17 credit hours must be selected from electives. Courses are offered at NCFST or via internet with the exception of FST 506, FST 593, FST 594, and FST 597.

Core Courses (15-18 credit hours)

FST 505 Food Microbiology
FST 506 Food Microbiology Laboratory (Required unless student has enough professional background experience to substitute, decision will be made by the NCFST Graduate Program Director.)
FST 507 Food Analysis
FST 521 Food Process Engineering
FST 524 Fundamentals of Food Science and Technology
FST 541 Principles of Food Packaging

Electives (14-17 credit hours)

FST 504 Food Biotechnology
FST 511 Food Law and Regulation
FST 522 Advanced Food Process Engineering
FST 531 HACCP Planning and Implementation
FST 593 Seminar Series
FST 594 Special Projects
FST 597 Special Problems

Students can enroll in FST 594 and 597 with a maximum of 6 credit hours total between both courses with an NCFST advisor approval. However, when 597 is used as a short course, the total credit hours must not exceed 8 between 594 and 597 combined. The student must have a minimum grade point average of 3.0/4. In addition to the core courses required of all students, further courses from BCPS or ChBE may be selected with the approval of the NCFST advisor to fit the background and needs of the individual student.

Certificate Programs

Food Safety and Technology (FST)

12 credits

The certificate program provides a student with post baccalaureate knowledge of food safety and technology and its applications in the food industry, and in federal and state public health agencies. The program requires a set of three to four courses that must be completed in three years with minimum GPA of 3.0/4.0. Students who are admitted to masters degree programs may apply coursework previously taken in a certificate program towards the requirements for the masters degree. Courses are offered at NCFST and via the internet, with the exception of FST 506.

Four Courses from the following (12 credit hours)

FST 504 Food Biotechnology
FST 505 Food Microbiology
FST 506 Food Microbiological Laboratory
FST 507 Food Analysis
FST 511 Food Law and Regulation
FST 521 Food Process Engineering
FST 524 Fundamentals of Food Science and Technology
FST 531 HACCP Planning and Implementation
FST 541 Principles of Food Packaging

Food Process Engineering (FPE)

Food Processing Specialist

12 credit hours

Students should refer to the Department of Chemical and Biological Engineering for additional details.

Course Descriptions

Numbers in parentheses indicate class, lab and credit hours, respectively.

FST 504
Food Biotechnology
Introduction of biotechnology in the food industry including genetic engineering of microorganisms. Fundamentals of microbial genomics and proteomics. Practice of a variety of software and bioinformatics tools including database search, sequence alignment, phylogenetic and cluster analyses, gene prediction, genomic map construction, structural and functional prediction of proteins. Applications of DNA fingerprinting techniques in food safety and public health. Prerequisite: Biology or Microbiology.
(3-0-3)

FST 505
Food Microbiology
Microorganisms of importance to food safety, spoilage, and food fermentations. Principles of occurrence and control of microbiological contaminants, methods for detection, mechanisms of microbial inactivation, and importance of sanitation and prevention of public health problems. Prerequisites: Introductory Microbiology or Food Science.
(3-0-3)

FST 506
Food Microbiology Laboratory
Basic microbiological techniques and safe laboratory practices. Introductory Food Microbiology, including isolation of pathogenic bacteria, spoilage microorganisms, sporeformers, fermentation, environmental monitoring and rapid identification methods. Prerequisites: Introductory Microbiology and Biochemistry.
(0-3-3)

FST 507
Food Analysis
Techniques for analyzing food toxins, food constituents of public health concern, intentional and unintentional food additives, and modern separation and analytical techniques. Prerequisites: Chemistry or Analytic Chemistry.
(3-0-3)

FST 511
Food Law and Regulation
Legal and scientific issues in regulating the nations food supply and nutritional status. Rules of regulatory agencies, Federal Food, Drug and Cosmetic Act, and definitions and standards for food and adulterated foods. Manufacturing processed foods in compliance with regulations.
(3-0-3)

FST 521
Food Process Engineering
Food engineering fundamentals, heat transfer in food processing, food rheology, freezing of foods, food dehydration, kinetics of chemical reactions in foods, refrigeration and thermal process calculations, alternative methods of food processing.
(3-0-3)

FST 522
Advanced Food Process Engineering
Process calculations for food processing methods such as canning, aseptic processing, ohmic heating, microwave processing and pulsed energy processing. Extrusion techniques in food processing, and discussions of new food processing techniques and safety implications. Prerequisite: FST/FPE 521.
(3-0-3)

FST 524
Fundamentals of Food Science and Technology
The science and chemistry of food as related to storage and processing of major food commodities including meats and poultry, seafood, fruits and vegetables, cereal grains and baked goods, eggs, dairy, and confectionaries. The effects of food-related unit operations such as drying, freezing, sterilization and radiation treatment on chemical and physical properties of food. An introduction to the global control of food quality and safety is also covered.
(3-0-3)

FST 531
HACCP Planning and Implementation
An introduction to good manufacturing practices (GMP) and other prerequisite programs, examination of the hazard analysis and critical control point (HACCP) concept, including an introduction to HACCP-regulated industries in the U.S. and international HACCP requirements, development and implementation of HACCP programs, generic HACCP modules, and hands-on development of individual and team HACCP plans.
(3-0-3)

FST 541
Principles of Food Packaging
Type and application of packaging materials. Migration theories and food package interaction, package testing to ensure safety, and recycling of packaging materials.
(3-0-3)

FST 591
Research and Thesis
Students conduct research on a particular topic and write a thesis. Students are also required to write manuscripts from thesis work for publication. Prerequisite: consent of instructor.
(Credit: Variable (6-8 hours))

FST 593
Seminar on Food Safety and Technology
Students attend seminars offered during the semester. Each student is also required to give a 20 minute presentation on a topic of interest or a research project on which he/she has worked.
(Credit: 1 hour)

FST 594
Special Projects
Advanced projects involving analysis of food safety processing, packaging and biotechnology systems. Please refer to program requirements for permitted credit hours. Prerequiste: NCFST advisor approval.
(Credit : 1-6 hours)

FST 597
Special Problems
Independent study focusing on current problems, issues of professional relevance. Topics selected from food process engineering, food safety, packaging and biotechnology. Please refer to program requirements for permitted credit hours. Prerequiste: NCFST advisor approval.
(Credit : 1-6 hours)

Undergraduate Courses Available to Graduate Students

With the approval of their NCFST advisors, students in the Food Process Engineering (FPE) graduate programs may apply up to 6 credits hours to their program from the following 400- level undergraduate courses.

Industrial Technology and Management

Suite 4001 South
3424 S. State Street
Chicago, IL 60616
312.567.3650
312.567.3655 fax
www.intm.iit.edu

Interim Director:
Mazin Safar

Program Coordinator:
Pamela Houser

The Master of Industrial Technology and Operations (M.I.T.O.) is a professional degree designed for individuals who plan to make a career in industry. The purpose of the M.I.T.O. program is to enhance the ability of the students to pursue their professional goals by providing up-to-date knowledge of the technologies and modern management approaches used in world-class industrial companies. The M.I.T.O. curriculum prepares students to move into management, supervisory and staff positions in industry. The M.I.T.O. is not an M.B.A. or an engineering degree, therefore it is not recommended for those planning to pursue careers in academia or research.

Degree Offered

Master of Industrial Technology and Operations

Admission Requirements

Applicants must hold a four-year bachelors degree from an accredited institution. Students with a GPA of 3.0/4.0 can be admitted unconditionally. Students with a GPA of 2.5/4.0 can be admitted contingent upon their earning a GPA of 3.3 or better in the first three courses taken at IIT. The GRE is not required for applicants who have completed a degree at a U.S. institution.

Applicants who have completed an undergraduate degree outside the U.S. must complete the GRE and submit scores with the admission application. Minimum required GRE scores are 2.5 for analytical and a combined score of 900 for the verbal and quantitative portions of the exam. Applicants from countries where English is not the primary language also must complete the TOEFL with a minimum score of 70 on the new Internet-based test (equivalent to 523 PBT) with no individual section scored below 15.

All applicants must submit a completed application form, the application fee, official transcripts (or certified copies) for all academic work at the college level, two letters of recommendation and a professional statement.

Prospective students who have previously obtained a M.S. or even a Ph.D. in highly technical subjects may be well served to pursue the M.I.T.O. degree. These individuals are often technical experts who, once employed in industry, have found that they lack an understanding of industrial operations, applied technologies and management skills. As a hybrid program covering both technology and management, the M.I.T.O. curriculum enables such specialists to move from technology into operations.

Students accepted into the program must have access to a Windows-based computer, the Internet and software for word processing, spreadsheet and presentation applications. All students will be required to use an IIT-issued email account.

Faculty

William Maurer, Industry Professor. B.S., University of Illinois; M.S., Keller Graduate School of Management.

Mazin Safar, Industry Professor and Associate Director of Industrial Technology and Management. B.S., Al-Hikma (Iraq); M.S., Illinois Institute of Technology; M.B.A., University of Chicago.

Adjunct Faculty

David Arditi, Professor of Civil and Architectural Engineering. B.S.C.E., M.S.C.E., Middle East Technical University (Turkey); Ph.D. Loughborough University.

Roya Ayman, Professor of Institute of Psychology. B.S., M.S., Ph.D., University of Utah. Leadership and team effectiveness, cross-cultural research, work and family interface, women and minorities in management, organizational climate and work attitudes and behaviors.

William Bobco, Adjunct Professor. B.S., M.B.A., University of Chicago. Production management, supply chain management.

John Caltagirone, Adjunct Professor. B.B.A., Loyola University. Supply chain management and logistics.

James Coates, Adjunct Professor. A.S.,Triton College. Heating, ventilation and cooling systems technology.

Blake Davis, Adjunct Professor. B.A., M.A., Illinois Institute of Technology. City and regional planning.

John Donahue, Adjunct Professor. J.D., John Marshall Law School; Ed.D., Roosevelt University. Human resource management.

Edmund Feldy, PE, Adjunct Professor. B.S., Illinois Institute of Technology, MBA,University of Chicago. Mechanical engineering and design, marketing and human behavior.

Jerry Field, Adjunct Professor. B.S., M.B.A., Roosevelt University; Ed.D. Loyola University (Chicago). Marketing, economics, curriculum instruction, adult instruction management.

Robert Foley, Adjunct Professor. B.S., University of Vermont; Ph.D. Northeastern Illinois University. Chemistry and material science and engineering.

Robert B. Footlik, PE, Adjunct Professor. B.S., Illinois Institute of Technology. Industrial engineering, warehousing operations, logistics and distribution technologies.

Joel Goldberg, Adjunct Professor. B.Ed , Northeastern Illinois University. Training, manufacturing processes, industrial management.

Gurram Gopal, Adjunct Professor. B.Tech., Indian Institute of Technology (India); M.S., Ph.D., Northwestern University. Chemical Engineering, industrial engineering, operations research, economics, finance.

Robert Hoffman, Adjunct Professor. Oxford and London School of Economics. Transportation, Logistics, and Economics.

Jagjit Jain, Adjunct Professor. B. Tech in Mechanical Engineering, MS in Operations Research, MBA in Finance/Economics/Accounting.

Andrew Kumiega, Adjunct Professor. B.S., University of Illinois (Chicago); M.S. , Illinois Institute of Technology; M.S., Ph.D., University of Illinois (Chicago). Engineering management, industrial engineering, finance.

Raymond Lemming, Adjunct Professor. B.S. in Civil Engineering, B.S. in Psychology, M.B.A. in Organizations and Management, Juris Doctor.

Philip Lewis, Adjunct Professor. B.S., Milwaukee School of Engineering. Industrial management, manufacturing processes.

Marvin Levine, Adjunct Professor. B.S., Illinois Institute of Technology, M.B.A., University of Chicago. Electrical engineering, engineering research, organizational behavior, international marketing and business.

Christopher Nemeth, CHFP, Adjunct Professor. B.A., Marquette University; M.S., Illinois Institute of Technology; Ph.D., Union Institute and University. Political science, product design, human factors, ergonomics.

John Prendergast, Adjunct Professor. B.A. in Occupational Education; M.A. in Education.

Irene Rozansky, Adjunct Professor. B.A., Purdue University; M.B.A., University of Massachusetts. Industrial risk assessment and management.

Rama Shankar, Adjunct Professor. B.S., Mechanical Engineering; M.S., Materials Management; M.S., Engineering Management. Quality control, industrial management and operations, six sigma.

Herb Shields, Adjunct Professor. B.S., Clarkson University. Electrical engineering, logistics, purchasing and acquisitions.

Muhammad Siddiqi, Adjunct Professor. B.S. Mechanical Engineering; M.I.T.O., Illinois Institute of Technology. Manufacturing processes, industrial organizations, quality control.

Prem Sud, Adjunct Professor. B.S., Punjab University (India); M.S., North Carolina State University. Mechanical engineering, industrial engineering and management.

Donatas Tijunelis, PE, Adjunct Professor. B.S., M.S. in Chemical Engineering, D.B.A.

Daniel Tomal, Adjunct Professor. B.S., M.S., Ph.D., Bowling Green State University. Electrical technology, industrial technology, administration and supervision.

John Twombly, CPA, ATJ, Clinical Professor in Stuart School of Business, Adjunct Professor in Industrial Technology and Management. B.S., University of Pennsylvania; M.B.A., Ph.D., Chicago. Economics, finance and statistics, accounting.

Master of Industrial Technology and Operations

The purpose of the M.I.T.O. program is to prepare students to move into management, supervisory and staff positions in industry by acquainting them with the current technologies and modern management approaches used in world-class industrial companies. Each students program of study is customized to best serve individual career objectives. Students have the option to complete a 12 credit hour specialization in Industrial Facilities (IF), Industrial Logistics (IL) or Manufacturing Technology (MT). Students may choose to complete an industrial specialization, or simply take the 10 courses of greatest interest. The flexibility of the M.I.T.O. program has enabled students to take courses from Stuart School of Business, Armour College of Engineering, and the Food Safety and Technology Program. Prospective students who have previously obtained a M.S. or even a Ph.D. in highly technical subjects may be well served to pursue the M.I.T.O.. Often such technical experts, once employed in industry, find that they lack an understanding of industrial operations, applied technologies and management skills. The M.I.T.O. curriculum enables such specialists to move from technology positions into operations. It is important to note that the M.I.T.O. is not an M.B.A. or an engineering degree, therefore it is not recommended for those planning to pursue careers in academia or research.

Of the 30 credit hours required for the M.I.T.O. degree, the student must complete at least 18 credit hours of INTM graduate courses. A student may choose to complete up to 12 credit hours of courses offered by other IIT departments, but must be suitably qualified and obtain permission to register from their advisor and the associated course instructor(s). Up to 12 credit hours of senior (400-level) courses may be completed as part of the M.I.T.O. degree. A maximum of 6 credit hours may be applied from special project courses (INTM 597 or an Interprofessional Project (IPRO 497)). A total of 9 credit hours taken at a different university (passed with the grade of B or better) may be transferred to IIT and applied towards the M.I.T.O. degree if those credits have not been applied toward any earned degree (subject to administrative approval). No thesis or comprehensive examination is required as part of this degree.

INTM courses are presented live and via interactive video at IITs Main Campus in Chicago and Rice Campus in Wheaton IL. In addition, the M.I.T.O. program can be completed entirely over the Internet. Using a delayed Internet format (lecture videos are posted within 24 hours after the live session), students can log on and attend class at the time and location of their choice. A demonstration of IIT web-based courses is available at www.iit-online.iit.edu.

Master of Industrial Technology and Operations

30 credit hours

Required credit hours

Elective courses 18-30 hours
Special project 0-6 hours
Optional specialization courses 12 hours

Elective Courses

INTM 502 Fundamentals of Industrial Engineering
INTM 507 Construction Technology
INTM 508 Cost Management
INTM 509 Inventory Control
INTM 511 Industrial Leadership
INTM 514 Topics in Industry
INTM 515 Advanced Project Management
INTM 518 Industrial Risk Management
INTM 520 Applied Strategies for the Competitive Enterprise
INTM 522 Computers in Industry
INTM 530 Transportation
INTM 531 Manufacturing Processes for Metals and Mechanical Systems
INTM 532 Manufacturing Processes for Electronics and Electrical Systems
INTM 533 Manufacturing Processes for Chemical and Process Systems
INTM 540 Supply Chain Management
INTM 542 Warehousing and Distribution
INTM 543 Purchasing
INTM 544 Export/Import
INTM 545 Strategic International Business
INTM 546 Manufacturing and Logistics Information Systems
INTM 560 The Carbon Economy
INTM 561 Energy Options for Industry

Up to 12 elective credits of 400-level INTM courses may be completed

Up to 12 elective credits of 400- or 500-level courses from a different academic discipline may be completed with advisor and instructor approval.

Specialization Courses

A specialization requires completion of four courses within an identified subject area.

Industrial Facilities

INTM 413 Facilities and Construction Administration
INTM 417 Construction Estimating
INTM 507 Construction Technology
INTM 515 Advanced Project Management

Industrial Logistics

INTM 509 Inventory Control
INTM 530 Transportation
INTM 540 Supply Chain Management
INTM 542 Warehousing and Distribution
INTM 543 Purchasing
INTM 544 Export/Import
INTM 546 Manufacturing and Logistics Information Systems

Manufacturing Technology

INTM 406 Quality Control
INTM 531 Manufacturing Processes for Metals and Mechanical Systems
INTM 532 Manufacturing Processes for Electronics and Electrical Systems
INTM 533 Manufacturing Processes for Chemical and Process Systems

Course Descriptions

Numbers in parentheses indicate class, lab and total credit hours, respectively.

INTM 502
Fundamentals of Industrial Engineering
Industrial engineering concepts are introduced and the student prepared to perform basic engineering tasks, including design of workstations, cells and lines. Coverage includes time and motion studies, work measurement, ergonomics, route sheets, plant layout, site selection, equipment selection, MRP, JIT, etc. Scheduling techniques will be covered along with material control techniques. Management Information Systems (MIS) are introduced and options covered.
(3-0-3)

INTM 507
Construction Technology
Introduces the full range of technologies involved in construction of both new and modified facilities, including steel, concrete and timber construction as well as supporting specialties such as HVAC, electrical, plumbing, etc. The interactions between the various construction trades will be covered along with the role of the architects and engineers.
(3-0-3)

INTM 508
Cost Management
Accounting basics are introduced with primary emphasis on the costing and estimating procedures as used in industry. The objective of this course is to provide a good understanding of financial activities and hands-on experiences in working with a variety of costing and accounting systems.
(3-0-3)

INTM 509
Fundamentals of Inventory Control
Fundamenals of inventory control, including inventory classifications, i.e. raw materials, work-in-process (WIP) and finished goods. Topics include inventory record keeping, inventory turnover, the 80/20 (or ABC) approach, external and internal lead times, excess/obsolete inventory, and inventory controls. Material Resource Planning (MRP) and Enterprise Resource Planning (ERP) are included.
(3-0-3)

INTM 511
Industrial Leadership
Supervision and management practices are key to all components and sectors of industry. People are the key resources and their effective use is critical to a successful operation. As companies move to become high performance organizations, traditional management tools and techniques have to be reviewed and reconsidered. Skills covered include motivation, developing consensus, conflict avoidance and negotiations. Group dynamics along with handling of individual workers is critical.
(3-0-3)

INTM 514
Topics in Industry
Provides overview of multiple industrial sectors and the influences that are forcing change. All aspects of industry are considered: history of industry, inventory, supply chain, e-commerce, management, manufacturing, industrial facilities, resource management, electronics and chemical industries, alternate energies, marketing, entrepreneurship, computers as tools, and other specialty areas.
(3-0-3)

INTM 515
Advanced Project Management
This course covers project management in the PMP framework and provides a structured approach to managing projects using Microsoft Project and Excel. Coverage includes creation of key project management charts (Gantt, Pert, CPM, timelines and resource utilization), basic statistics used in estimating task times, critical path generation in Excel and Project, project cost justification in Excel, SPC and acceptance sampling for machine acceptance, project analysis via simulation, and management of personnel, teams, subcontractors and vendors. Case studies are utilized to demonstrate core concepts and dynamic scheduling.
(3-0-3)

INTM 518
Industrial Risk Management
Each year industrial companies are affected by critical incidents which cause disruptions in operations and significant monetary losses due to repairs and/or lost revenue. Whether it is a small fire, an extended electrical outage or an incident of a more serious magnitude, all company stakeholders - from the board of directors to the employees to the customers - are impacted. The key to understanding the complexities of industrial resiliency lies in focusing on the issues of preparedness: prevention, mitigation and control. This course is designed to prepare the student for managing a critical incident, including understanding risk and business impact, emergency preparedness, contingency planning and damage control.
(3-0-3)

INTM 520
Applied Strategies for the Competitive Enterprise
Course covers the application of proven management principles and operational practices. Learn how high performance companies create a competitive advantage despite economic challenges and a transitional customer base. Factors covered include strategy deployment, financial analysis, new product development, quality, customer service, and attaining market leadership. Case studies illustrate variable impacts on business situations.
(3-0-3)

INTM 522
Computers in Industry
Computers are ubiquitous in all industrial sectors. Management Information Systems (MIS) are available for even the most complex of industrial operations. The integration of MIS with operational specialties (such as order entry, production scheduling, quality control, shipping and invoicing) is discussed. A variety of Microsoft Excel tools are introduced and utilized to set up approaches for handling a variety of industrial situations.
(3-0-3)

INTM 530
Transportation
Course covers transportation practices and strategies for the 21st century. The role and importance of transportation in the economy and its relationship to the supply chain will be covered in detail. Transportation modes-truck, rail, air, and water-will be examined for both domestic and global transportation. Costing and pricing strategies and issues will be discussed. Security issues in domestic and international transportation will be part of the course. Lectures with years of practical transportation experience in the corporate world will provide students with their perspective on the role of transportation in today's economy
(3-0-3)

INTM 531
Manufacturing Processes for Metals and Mechanical Systems
Material processing and manufacturing techniques are covered for solid materials, including metals, plastics, ceramics and glass. Making of parts from these materials is covered along with subsequent assembly of these parts into components, subassemblies and final products. Advanced Manufacturing Technologies (AMT) will be covered including robots, lasers, AGVs, etc. The industrial structure that makes up this sector of manufacturing will be covered.
(3-0-3)

INTM 532
Manufacturing Processes for Electronics and Electrical Systems
The materials used in Electronic and Electrical (E&E) manufacturing will be reviewed including materials and components that are used to produce chips, PCBs and wiring systems. Focus will be on the processes for producing the range of parts and products included in this broad sector. Automation for producing parts and assemblies will be covered. Techniques covered will include surface mounted technology (SMT), wave soldering, automation insertion, automated inspection, etc. The industrial structure that makes up this sector of manufacturing will be covered.
(3-0-3)

INTM 533
Manufacturing Processes for Chemical and Process Systems
This course will cover materials and manufacturing based on process systems. This would include painting, anodizing, plating, plastic preparation, plastics manufacturing, cleaning, etc. along with the processes for producing the chemicals involved. Environmental and hazardous material issues are of importance and "green systems" that minimize the use of resources are encouraged. OSHA, EPA and other regulatory systems will be covered. The industrial structure that makes up this sector of manufacturing will be covered.
(3-0-3)

INTM 540
Supply Chain Management
This course covers the full range of activities involved in the supply chain. This includes management tools for optimizing of supply chains, relationships with other parts of the organization, in-house versus third party approaches, and suitable performance measurements. Topics covered include: Warehouse Management Systems (WMS), Transportation Management Systems (TMS), Advanced Planning and Scheduling Systems (APS), as well as cost benefit analysis to determine the most appropriate approach.
(3-0-3)

INTM 542
Warehousing and Distribution
This course covers warehouse layout and usage based on product requirements such as refrigeration, hazardous material, staging area, and value added activities. Processes covered include receiving, put-away, replenishment, picking and packing. The requirement for multiple trailer/rail car loading and unloading is considered as well as equipment needed for loading, unloading, and storage. Computer systems for managing the operations are reviewed. Emphasis is on material handling from warehouse arrival through warehouse departure.
(3-0-3)

INTM 543
Purchasing
Purchasing responsibilities, processes, and procedures are included. Topics covered include: supplier selection and administration, qualification of new suppliers, preparing purchase orders, negotiating price and delivery, strategic customer/vendor relationships, and resolution of problems. All aspects of Supplier Relation Management (SRM) are covered.
(3-0-3)

INTM 544
Export/Import
Internationalization of industry requires special expertise and knowledge, which must be taken into consideration throughout all interactions with overseas companies either as customers or suppliers. Topics covered include custom clearance, bonded shipping, international shipping options, import financing and letters of credit, customer regulations, insurance, import duties and trade restrictions, exchange rates, and dealing with different cultures.
(3-0-3)

INTM 545
Strategic International Business
Understanding international business strategies is fundamentally important to businesses of any size in today's competitive, worldwide marketplace. Course objectives include providing a background in international business fundamentals, economics, human resources, cultural issues and interrelationships, as well as understanding the business decision processes involved in product planning, marketing, and organizational planning, structure and performance. Includes development of managerial skills for international business related to strategic planning, marketing and sales policy, and implementation of organizational goals.
(3-0-3)

INTM 546
Manufacturing and Logistics Information Systems
This course provides an overview of manufacturing and supply chain information systems, tools, and techniques utilized for effective decision making. Current state-of-the-art and commercially available industrial software packages, such as MRP, WMS, TMS, APS, etc., will be used and their impact on management decision making analyzed.
(3-0-3)

INTM 560
The Carbon Economy
The worlds economy is highly dependent on fossil fuel removed from the ground as coal, oil or natural gas. Population and economic growth are expected to increase dependence on these carbon resources. Concerns about global warming caused by increasing levels of carbon dioxide require consideration of approaches to mitigate the impact. This course examines current approaches to mitigating the problems through increased energy efficiency and sequestering the carbon. Also covered are approaches using biomass and agricultural wastes to provide renewable carbon sources.
(3-0-3)

INTM 561
Energy Options for Industry
Carbon-based fuels are a limited resource and within decades will be in very short supply. Associated energy costs will increase and industry will be required to incorporate alternate fuels and/or power sources, such as uranium (for nuclear power), hydroelectric, geothermal, wind, wave, solar, etc. This course presents such energy options and explores the anticipated impact on industry.
(3-0-3)

Information Technology and Management

IIT School of Applied Technology

Daniel F. and Ada L. Rice Campus
201 E. Loop Road
Wheaton, IL 60187
www.iit.edu/applied_tech/

Dean and Program Director:
C. Robert Carlson
630.682.6002
carlson@iit.edu

The mission of the Master of Information Technology & Management program is to educate and inform students to prepare them to assume technical and managerial leadership in the information technology field. The Information Technology and Management program applies a hands-on, reality-based approach to education that allows students to apply what they learn in class to solve real-life problems. The program provides an innovative experience where students work on cutting-edge, industry-sponsored projects. This teaching philosophy prepares students to become innovators, entrepreneurs and leaders of the future. For some areas of study, it is possible to complete the entire MITM degree on-line.

Degree Offered

Master of Information Technology & Management

Certificate Programs

Advanced Software Development
Computer and Network Security Technologies
Data Center Operations and Management
Data Management and Analytics
Digital Voice and Data Communication Technologies
Information Technology Innovation, Leadership and Entrepreneurship
Information Security Management
Systems Analysis
System Administration
Web Design and Application Development

Faculty

C. Robert Carlson, Professor, Dean of the IIT School of Applied Technology and Academic Director, Information Technology and Management Degree Programs. B.A. Augustana College, Ph.D. University of Iowa. Database design, object-oriented modeling and design, software engineering, and IT entrepreneurship

Carol Davids, Alva C. Todd Industry Professor and Director of the VoIP Laboratory, IIT School of Applied Technology. B.S.E.E. Cornell University, M.I.T.M. Illinois Institute of Technology. Voice over IP, voice and data networks, and digital and voice communications.

Dennis Hood, Adjunct Industry Professor. B.S. Rensselaer Polytechnic Institute, M.S. Stevens Institute of Technology. Project Management, process engineering, and information technology management.

Jeffrey Kimont, Industry Associate Professor. B.S.E.E. Midwest College of Engineering, M.S.C.S. North Central College. Object-oriented programming, client-server programming, agile programming, Web application development, embedded systems, intelligent device application development, cloud computing and grid computing.

William Lidinsky, Alva C. Todd Industry Professor and Director of the Security and Forensics Laboratory, IIT School of Applied Technology. B.S.E.E., M.S.E.E. Illinois Institute of Technology, M.B.A. University of Chicago. Computer networking, computer and network security, computer and network forensics and steganography.

Valerie Scarlata, Industry Associate Professor and Director, Graduate Admissions & Student Affairs, Information Technology and Management Degree Programs. B.A. Columbia College, M.I.T.M. Illinois Institute of Technology. Online design, Web application development, rich client applications, multimedia, human-computer interaction and instructional technologies.

Raymond E. Trygstad, Industry Professor, Associate Director and Director of Undergraduate Advising, Information Technology and Management Degree Programs, and Director of Information Technology, IIT School of Applied Technology. B.S. United States Naval Academy, M.S.S.M. University of Denver. System administration, operating system virtualization, information security management, information technology policy, cloud computing, open source operating systems and applications, and multimedia.

Laboratories and Research Centers

The IIT School of Applied Technology operates and administers over 200 computers and servers at the Main and Rice Campuses to support teaching, learning and research. Nine laboratories include Sun Solaris facilities, a networking/network security and computer forensics facil-ity, a dedicated Voice over IP (VoIP) facility which includes an entire CISCO VoIP LAN as well as video and mesh wireless capabilities, and the worlds first 10GBASE-T 10-gigabit Ethernet academic computing facility. The security/forensics, VoIP and 10GBASE-T laboratories provide additional facilities for student projects and applied research, some of which is undertaken in conjunction with industry partners. All laboratories are normally available for student use outside of class hours, and one or more laboratories are available for student use weekdays between 10 am and 10 pm at the Rice Campus. A wireless network at the Rice Campus provides complete coverage of the campus and operates at all times that the campus is open. Students make extensive use of the network infrastructure provided to support personal notebook computers.

Admission Requirements

Applicants for admission must have earned a four-year bachelors degree from an accredited institution with a minimum cumulative undergraduate GPA of 3.0/4.0. International applicants are required to submit a GRE score with a minimum score of 1200 (combined score for tests taken prior to Oct. 1, 2002) or 900 quantitative + verbal and 2.5 analytical writing (for tests taken on or after Oct. 1, 2002) and may be required to submit a TOEFL score (see requirements within this bulletin). Admission as a non-degree student follows the university policy set forth in this bulletin.

Students whose undergraduate degree is not in a computer-related area or who do not have significant experience or certifications in the information technology field will be required to demonstrate proficiency in the undergraduate courses that are prerequisites for the graduate program.

Proficiency may be demonstrated by taking and passing a written exam or taking and passing, with a grade of B or better, the prerequisite undergraduate courses at IIT. Current prerequisites for the Master of Information Technology & Management include computer hardware and operating system literacy (ITM 301 or ITM 302 or equivalent course-work, certification or experience) and an ability to program at a basic level using a contemporary programming language (ITM 311 or ITM 312 or equivalent coursework, certification or experience). Students enrolled in undergraduate post-baccalaureate studies (see information at the front of this bulletin) may take these courses as part of that program. Proficiency may also be demonstrated by presentation of documentation of equivalent training or certification; in this case waivers of the prerequisites may only be granted by the graduate adviser or the ITM Associate Director.

Placement Examinations

Students entering the Master of Information Technology and Management degree program may be required to take placement examinations based on an evaluation of their background and their undergraduate degree program.

Students may be required to demonstrate proficiency in the use of a contemporary object-oriented programming language through completion of a programming proficiency examination. Students will be requested to complete a representative set of basic programming tasks and will have a choice of programming languages in which to complete the tasks; Visual Basic is not an acceptable language for this purpose. References may be consulted, but the test is timed so ability to code is necessary. Students who cannot satisfactorily complete the exam may be required to attend a refresher workshop or short course in their selected programming language, or may be required to complete an ITM programming course; the appropriate action will be based on their score on the exam.

Students who are not required to complete the Test of English as a Foreign Language (TOEFL) but have very low scores on the GRE Verbal (generally 10th percentile or lower) may be required to complete the IIT English Proficiency Review (EPR) Essay Examination. If students cannot pass this examination they will be required to enroll in ENG 053 and retake the EPR Essay Exam at course completion.

Master of Information Technology & Management

30 credit hours (Courses may be selected from 400-and 500-level courses; a minimum of 18 credit hours must be at the 500-level or higher.)
GPA of 3.0/4.0 or better

Students whose undergraduate degree is not in a computer-related area or who do not have significant experience or certifications in the information technology field will be required to complete core courses or demonstrate their knowledge through equivalent coursework, certification or experience. These core courses will ensure an ability to program at a competent level using a contemporary programming language (ITM 411); basic knowledge of networking concepts, protocols and methods (ITM 540); knowledge of the Internet, including the ability to build Web sites and deliver them on a server (ITM 461); and the ability to create and administer databases using a modern database management system (ITM 421). Students enrolled in undergraduate post-baccalaureate studies (see page 28) may take these courses as part of that program, but they will not then be applied to their graduate degree.

The following course groupings are meant to guide students in their course selection, allowing them to focus on a particular area of information technology, depending on their interests, background and career goals: alternative courses in each specialization may be available at the discretion of the students advisor. Final determination of completion of a specialization will be made by a students graduate adviser. Students are not required to choose a specialization for degree completion and can mix courses from different specializations: a general program of study is also available.

Core Courses (9 hours)

Required courses

ITM 411 Intermediate Software Development

AND 6 hours chosen from the following

ITM 421 Data Modeling and Applications
ITM 561 Internet Technologies & Web Design
ITM 540 Introduction to Data Networks and the Internet

Notes: Core courses may be waived upon presentation of evidence of equivalent coursework, certification or experience or successful completion of the placement examination. Approval of waivers will be made by the students adviser or the ITM Associate Director. If any one core course is waived, students must still complete nine hours of core course content. Core courses that also apply to specializations will still fulfill the core course requirement.

Computer and Information Security (18 hours)

Recommended courses (9 hours)

ITM 548 System and Network Security
ITM 578 Information Systems Security Management

AND 3 hours chosen from the following:

ITM 518 Coding Security
ITM 528 Database Security
ITM 538 Computer & Network Forensics
ITM 539 Steganography
ITM 543 Vulnerability Analysis and Control
ITM 549 System and Network Security: Projects & Advanced Methods
ITM 558 Operating System Security
ITM 588 Incident Response, Disaster Recovery and Business Continuity

AND 9 hours chosen from the following:

ITM 518 Coding Security
ITM 528 Database Security
ITM 538 Computer & Network Forensics
ITM 539 Steganography
ITM 543 Vulnerability Analysis and Control
ITM 549 System and Network Security: Projects & Advanced Methods
ITM 551 Distributed Workstation System Administration

OR

ITM 552 Client-Server System Administration
ITM 558 Operating System Security
ITM 579 Topics in Information Security
ITM 586 Information Technology Auditing
ITM 588 Incident Response, Disaster Recovery and Business Continuity

Voice and Data Communication Technology (18 hours)

Recommended courses (9 hours)

ITM 540 Introduction to Data Networks and the Internet
ITM 545 Telecommunications Technology
ITM 546 Voice Communications Over Data Networks

AND 9 hours chosen from the following:

ITM 541 Network Administration and Operations
ITM 542 Wireless Technologies and Applications
ITM 543 Vulnerability Analysis and Control
ITM 547 Voice Communications Over Data Networks: Projects & Advanced Methods
ITM 548 System and Network Security
ITM 549 System and Network Security: Projects & Advanced Methods
ITM 571 Project Management for Information Technology Management
ITM 575 Networking and Telecommunications Management

IT Management and Entrepreneurship (18 hours)

Recommended courses (9 hours)

ITM 571 Project Management for Information Technology Management
ITM 574 Information Technology Management Frameworks
ITM 581 IT Entrepreneurship

AND 9 hours chosen from the following:

ITM 531 Object Oriented System Analysis, Modeling and Design
ITM 532 UML Based Software Development
ITM 572 Process Engineering for Information Technology Managers
ITM 573 Building & Leading Effective Teams
ITM 575 Networking and Telecommunications Management
ITM 578 Information Systems Security Management
ITM 582 Business Innovation
ITM 585 Legal and Ethical Issues in Information Technology
ITM 586 Information Technology Auditing
INTM 511 Industrial Leadership
INTM 515 Advanced Project Management
INTM 522 Computers in Industry
INTM 534 Resource Management
INTM 543 Purchasing

Data Management (18 hours)

Recommended courses (9 hours)

ITM 421 Data Modeling and Applications
ITM 422 Advanced Database Management
ITM 528 Database Security

AND 9 hours chosen from the following:

ITM 521 Client Server Technologies and Applications
ITM 526 Data Warehousing
ITM 527 Data Analytics
ITM 529 Advanced Data Analytics
ITM 531 Object Oriented System Analysis, Modeling and Design
ITM 574 Strategic Information Technology Management
ITM 578 Information Systems Security Management

Web Design and Application Development (18 hours)

Recommended Courses (9 hours)

ITM 461 Internet Technologies & Web Design
ITM 562 Web Application Development
ITM 571 Project Management for Information Technology Management

AND 9 hours chosen from the following:

ITM 411 Intermediate Software Development
ITM 515 Advanced Software Development
ITM 519 Topics in Software Development
ITM 541 Network Administration and Operations
ITM 563 Internet Application Development
ITM 565 Rich Internet Applications
ITM 566 Service-Oriented Architectures
ITM 569 Topics in Application Development
COM 525 Research and Usability Testing

Systems Analysis (18 hours)

Recommended courses (9 hours)

ITM 531 Object Oriented System Analysis, Modeling and Design
ITM 571 Project Management for Information Technology
ITM 572 Process Engineering for Information Technology Managers

AND 9 hours chosen from the following:

ITM 511 Application Development Methodologies
ITM 532 UML Based Software Development
ITM 534 Human Computer Interaction
ITM 535 Systems Architecture
ITM 536 Software Testing and Maintenance
ITM 574 Information Technology Management Frameworks
ITM 575 Networking and Telecommunications Management
ITM 578 Information Systems Security Management
ITM 586 Information Technology Auditing
INTM 522 Computers in Industry

Data Center Operations and Management

Recommended courses (12 hours)

ITM 535 Data Center Architecture
ITM 540 Introduction to Data Networks and the Internet
ITM 554 Operating System Virtualization
ITM 576 Data Center Management

AND 6 hours chosen from the following:

ITM 526 Data Warehousing
ITM 527 Data Analytics
ITM 529 Advanced Data Analytics
ITM 544 Cloud Computing Technologies
ITM 546 Voice Communications Over Data Networks
ITM 548 System and Network Security
ITM 588 Incident Response, Disaster Recovery and Business Continuity

Software Development (18 hours)

Recommended courses (9 hours)

ITM 515 Advanced Software Development
ITM 532 UML Based Software Development
ITM 571 Project Management for Information Technology Management

AND 9 hours chosen from the following:

ITM 411 Intermediate Software Development
ITM 412 Advanced Software Development
ITM 511 Application Development Methodologies
ITM 513 Open Source Programming
ITM 518 Coding Security
ITM 519 Topics in Software Development
ITM 521 Client Server Technologies and Applications
ITM 531 Object Oriented System Analysis, Modeling and Design
ITM 534 Human Computer Interaction
ITM 536 Software Testing and Maintenance
ITM 567 Enterprise Web Application Development
ITM 572 Process Engineering for Information Technology Managers

Systems Administration (18 hours)

Recommended courses (9 hours)

ITM 541 Network Administration and Operations
ITM 551 Distributed Workstation System Administration

OR

ITM 552 Client-Server System Administration

AND 9 hours chosen from the following:

ITM 456 Introduction to Open Source Operating Systems
ITM 544 Cloud Computing Technologies
ITM 551 Distributed Workstation System Administration

OR

ITM 552 Client-Server System Administration
ITM 554 Operating System Virtualization
ITM 558 Operating System Security
ITM 571 Project Management for Information Technology Management
ITM 574 Information Technology Management Frameworks
ITM 575 Networking and Telecommunications Management

Management Information Systems (18 hours)

Recommended courses (9 hours)

ITM 421 Data Modeling and Applications
ITM 422 Advanced Database Management I
ITM 571 Project Management for Information Technology

AND 9 hours chosen from the following:

ITM 526 Data Warehousing
ITM 527 Data Analytics
ITM 528 Database Security
ITM 529 Advanced Data Analytics
ITM 531 Object Oriented System Analysis, Modeling and Design
ITM 532 UML Based Software Development
ITM 554 Operating System Virtualization
ITM 572 Process Engineering for Information Technology Managers
ITM 574 Information Technology Management Frameworks
ITM 586 Information Technology Auditing
INTM 515 Advanced Project Management
INTM 522 Computers in Industry

Digital Systems Technology (18 hours)

Recommended courses (9 hours)

ITM 533 Operating System Design Implementation
ITM 555 Intelligent Device Applications
ITM 593 Embedded Systems

AND 9 hours chosen from the following:

ITM 511 Application Development Methodologies
ITM 540 Introduction to Data Networks and the Internet
ITM 541 Network Administration and Operations
ITM 542 Wireless Technologies and Applications
ITM 544 Cloud Computing Technologies
ITM 545 Telecommunications Technology
ITM 546 Voice Communications Over Data Networks
ITM 556 Intelligent Device Project
INTM 522 Computers in Industry

Master of Information Technology & Management: General Course of Study

These are selected groupings of courses allowing students enrolled in the Master of Information Technology & Management degree to develop a broad overview knowledge of information technology. Suggested courses in each area are marked with an asterisk (*) with one alternative course listed for each area; more alternatives may be pos-sible at the discretion of the students advisor.

Web Design and Application Development

*ITM 461 Internet Technologies & Web Design
ITM 562 Web Site Application Development
ITM 574 Strategic Information Technology Management

Data Management

*ITM 421 Data Modeling and Applications
*ITM 531 Object Oriented System Analysis, Modeling and Design
ITM 521 Client Server Technologies and Applications

Information Technology Management

*ITM 571 Project Management for Information Technology
ITM 574 Information Technology Management Frameworks
ITM 586 Information Technology Auditing

Networking and Communications

*ITM 540 Introduction to Data Networks and the Internet
*ITM 548 System and Network Security
ITM 541 Network Administration and Operations

Systems Administration

*ITM 551 Distributed Workstation System Administration

OR

*ITM 552 Client-Server System Administration

Software Development

*ITM 411 Intermediate Object Oriented Programming
*ITM 571 Project Management for Information Technology Management
ITM 532 UML Based Software Development Computer & Information Security

Computer & Information Security

*ITM 578 Information Systems Security Management
ITM 528 Database Security
ITM 548 System and Network Security

Certificate Programs

Certificate programs offer working professionals an opportunity to increase their knowledge and skills in the specific areas of information technology. A certificate representing proven academic performance is presented after the required coursework is completed with a GPA of 3.0/4.0. All courses may be later applied toward the Master of Information Technology and Management degree for those who apply and are accepted to the degree program. Courses taken may be later applied toward a degree program. Applicants should have a bachelors degree from an accredited college or university; the degree need not be in an information technology or computer related field. Prerequisites may be required for some courses in certificates; these prerequisites will not be applied to the certificate.

Computer and Network Security Technologies Certificate

This program is designed for students seeking knowledge that will prepare them for careers in computer and network security technologies and to deal with the challenging computer and network security problems facing society.

Required Courses

ITM 543 Vulnerability Analysis and Control
ITM 548 System and Network Security

AND any two of the following six courses:

ITM 518 Coding Security
ITM 528 Database Security
ITM 538 Computer & Network Forensics
ITM 539 Steganography
ITM 549 System and Network Security: Projects & Advanced Methods
ITM 558 Operating System Security

Information Security Management Certificate

This program is designed for students seeking knowledge that will prepare them for careers in the management of information security.

Required Courses

ITM 548 System and Network Security
ITM 578 Information System Security Management

AND any two of the following four courses:

ITM 543 Vulnerability Analysis and Control
ITM 579 Topics in Information Security
ITM 586 Information Technology Auditing
ITM 588 Incident Response, Disaster Recovery and Business Continuity
ITM 579 Topics in Information Security (may be applied to this certificate twice.)

Digital Voice and Data Communication Technologies Certificate

This program is designed for students seeking knowledge that will prepare them for careers in digital voice and data communications.

Required Courses

ITM 540 Introduction to Data Networks and the Internet
ITM 545 Telecommunications Technology
ITM 546 Voice Communications Over Data Networks

AND select any one of the following three courses:

ITM 541 Network Administration and Operations
ITM 547 Voice Communications Over Data Networks: Projects & Advanced Methods
ITM 575 Networking & Telecommunications Management

Students who have already completed coursework, training, or certification equivalent to ITM 540 may substitute a fourth course from the above list.

Information Technology Innovation, Leadership and Entrepreneurship Certificate

This program is designed for students seeking knowledge that will prepare them to be leaders, innovators and entrepreneurs in the field of information technology.

Required Courses

ITM 571 Project Management for Information Technology Management
ITM 581 IT Entrepreneurship
ITM 582 Business Innovation

AND select any one of the following eleven courses:

ITM 572 Process Engineering for Information Technology Managers
ITM 573 Building & Leading Effective Teams
ITM 574 Information Technology Management Frameworks
ITM 575 Networking and Telecommunications Managment
ITM 578 Information Systems Security Management
ITM 585 Legal and Ethical Issues in Information Technology
INTM 511 Industrial Leadership
INTM 515 Advanced Project Management
INTM 522 Computers in Industry
INTM 534 Resource Management
INTM 543 Purchasing

Students who have already completed coursework, training, or certification equivalent to ITM 571 may substitute a fourth course from the above list. Only one INTM course may be applied to the certificate.

Data Management and Analytics Certificate

This program is designed for students seeking knowledge that will prepare them for careers in data management and analytics.

Required Courses

ITM 421 Data Modeling and Applications
ITM 422 Advanced Database Management
ITM 527 Data Analytics

AND any one of the following four course:

ITM 526 Data Warehousing
ITM 528 Database Security
ITM 529 Advanced Data Analytics
ITM 531 Object Oriented System Analysis, Modeling and Design

Students who have already completed coursework, training, or certification equivalent to ITM 421 may substitute a fourth course from the above list.

Web Design and Application Development Certificate

This program is designed for students seeking knowledge that will prepare them for careers in Web design and application development.

Required Courses

ITM 461 Internet Technologies & Web Design
ITM 562 Web Application Development

AND select any two of the following six courses:

ITM 564 Advanced Web Application Development
ITM 565 Rich Internet Applications
ITM 566 Service-Oriented Architectures
ITM 569 Topics in Application Development
ITM 571 Project Management for Information Technology Management
COM 525 Research and Usability Testing

Students who have already completed coursework, training, or certification equivalent to ITM 461 may substitute a fourth course from the above list.

Data Center Operations and Management Certificate

This program is designed for students seeking knowledge that will prepare them for a career in data center operations.

Required Courses:

ITM 535 Data Center Architecture
ITM 540 Introduction to Data Networks and the Internet
ITM 554 Operating System Virtualization
ITM 576 Data Center Management

Students who have already completed coursework, training, or certification equivalent to ITM 540 may substitute a fourth course from the list below.

ITM 544 Cloud Computing Technologies
ITM 548 System and Network Security
ITM 588 Incident Response, Disaster Recovery and Business Continuity

Systems Analysis Certificate

This program is designed for students seeking knowledge that will prepare them for a career as a systems analyst.

Required Courses

ITM 531 Object Oriented System Analysis, Modeling and Design
ITM 571 Project Management for Information Technology
ITM 572 Process Engineering for Information Technology Managers

AND select any one of the following five courses:

ITM 511 Application Development Methodologies
ITM 532 UML Based Software Development
ITM 534 Human Computer Interaction
ITM 536 Software Testing and Maintenance
INTM 522 Computers in Industry

Students who have already completed coursework, training, or certification equivalent to ITM 571 may substitute a fourth course from the above list

Advanced Software Development Certificate

This program is designed for students seeking knowledge that will enhance their skills as a software developer.

Required Courses

ITM 515 Advanced Software Development
ITM 571 Project Management for Information Technology Management

AND select any two of the following seven courses:

ITM 511 Application Development Methodologies
ITM 513 Open Source Programming
ITM 518 Coding Security
ITM 519 Topics in Software Development
ITM 532 UML Based Software Development
ITM 534 Human Computer Interaction
ITM 536 Software Testing and Maintenance

Students who have already completed coursework, training, or certification equivalent to ITM 571 may substitute a fourth course from the above list.

System Administration Certificate

This program is designed for students seeking knowledge that will prepare them for a career as a systems administrator.

Complete one of the following two six-credit-hour courses:

ITM 551 Distributed Workstation System Administration
ITM 552 ClientServer System Administration

AND select any two of the following five courses:

ITM 456 Introduction to Open Source Operating Systems
ITM 544 Cloud Computing Technologies
ITM 554 Operating System Virtualization
ITM 558 Operating System Security
ITM 571 Project Management for Information Technology Management

Accelerated Courses

The program may offer accelerated courses for credit in several areas of information technology & management. (Students should see the definition of accelerated courses within the front of this bulletin).

Accelerated courses provide an opportunity for degreeseeking students at lIT to complete graduate degree re-quirements in a shorter time period. If taken by non-degree seeking students, all courses may be later applied toward the Master of Information Technology and Management degree for those who apply and are accepted to the degree program

CourseDescriptions

Numbers in parentheses indicate class, lab and credit hours, respectively.

ITM 411
Intermediate Software Development
This course covers a broad spectrum of object-oriented programming concepts and application programming interfaces. The student considers the details of object-oriented development in topics of multi-threading, data structure collections, stream I/O and client interfaces. Software engineering topics of packaging and deployment are covered as well. Hands-on exercises reinforce concepts taught throughout the course. Prerequisite: ITM 311.
(2-2-3)

ITM 412
Advanced Structures and Systems Programming
Structured programming continues with advanced concepts including strings, arrays, pointers, data structures, file manipulation, and dynamic memory management. Students create more complex applications that work with user input, manipulate user supplied text or text obtained from a file, apply standard library routines for working with literal text, use pointers to store complex structures within arrays, and read and write data from files, the console, and the terminal. The object-oriented programming (OOP) paradigm is covered in depth includeing the philosophy of OOP, classes and objects, inheritance, template classes, and making use of class libraries. Prerequisite: ITM 312.
(2-2-3)

ITM 421
Data Modeling and Applications
Basic data modeling concepts are introduced. Hands-on database design, implementation, and administration of single-user and shared multi-user database applications using a contemporary relational database management system.
(2-2-3)

ITM 422
Advanced Database Management
Advanced topics in database management and programming including client server application development are introduced. Expands knowledge of data modeling concepts and introduces object-oriented data modeling techniques. Stu-dents will learn the use of Structured Query Language in a variety of application and operating system environments. Prerequisite: ITM 421. (C)
(3-0-3)

ITM 456
Introduction to Open-Source Operating Systems
Students learn to set up and configure an industry-standard open source operating system, including the actual installation of the operating system on the student workstation. Also addressed are applications and graphical user interfaces as well as support issues for open source software. Prerequisite: ITM 302 or per-mission of instructor.
(2-2-3)

ITM 460
Fundamentals of Multimedia
Students are introduced to computerbased multimedia theory, concepts and applications. Topics include desktop publishing, hypermedia, presentation graphics, graphic images, animation, sound, video, multimedia on the World Wide Web and integrated multimedia authoring techniques. Prerequisite: Permission of instructor.
(2-2-3)

ITM 461
Internet Technologies & Web Design
This course will cover how the Internet is organized, addressing, routing, DNS, protocols, TCP/IP, SMTP, the use of Internet applications, and the creation of Web pages using HTML and graphical applications. Networked multimedia distribution technologies are also explored. The design of effective Web site including page layout, user interface design, graphic design, content flow and site structure as well as management of Web site resources including intranet management and design considerations are addressed. Students design and create a major Web site with multiple pages and cross-linked structures. (C)
(2-2-3)

ITM 492
Embedded Systems and Reconfigurable logic design
This course covers embedded system design as well as reconfigurable logic design using a hardware description language (VHDL). Students will discover hardware, software and firm-ware design trade-offs as well as best practices in current embedded systems development. Real-time operating system (RTOS) topics will be considered to further emphasize embedded hardware-software impacts. A final project will integrate course topics into a System On a Chip (SOC) design including intellectual property (IP) implemented in a Field-programmable Gate Array (FPGA) and driven by application code loaded from either the development platform or from onboard firmware. Prerequisite: Knowledge of digital logic and C or instructor consent.
(4-4-6)

ITM 495
Topics in Information Technology
This course will cover a particular topic, varying from semester to semester, in which there is particular student or staff interest. Prerequisite: consent of instructor.
(Credit : Variable)

ITM 511
Application Development Methodologies
Students learn concepts in a systematic approach to the analysis, design, implementation and maintenance of software. Includes studies of the various models of the software life-cycle, software development project management, system requirements analysis, and methodologies for practical application of these models to software development, including the use of CASE (Computer Aided Software Engineering) tools. Students apply these principles in projects to improve the quality of their development process and final products. Prerequisite: ITM 412 or significant software development experience.
(2-2-3)

ITM 513
Open Source Programming
Contemporary opensource programming languages and frameworks are presented. The student considers design and development topics in system, graphical user interface, network and web programming. Dynamic scripting languages are covered using objectoriented, concurrent and functional programming paradigms. Concepts gained throughout the course are reinforced with numerous exercises which will culminate in an opensource programming project. Prerequisite: ITM 411.
(2-2-3)

ITM 515
Advanced Software Development
This course considers Web container application development for enterprise systems. The primary focus is on database connectivity (JDBC) integration with Web application programming using an enterprise-level application framework. A Web application term project considers the design and implementation of a database instance that serves as the information tier in a contemporary 3-tier enterprise solution. Prerequisite: ITM 411.
(2-2-3)

ITM 518
Coding Security
This course examines security architecture elements within modern object-oriented programming languages that create the framework for secure programming. Analysis of components and services with their inherent strength and weaknesses give rise to common coding security challenges. An exploration of identity management, encryption services and common hacking techniques will enable the student to evaluate the level of a systems data exposure. Coding Standards, best practices, guidelines and style will further enhance the student's ability to develop secure code. Homework assignments and a final project will reinforce the theories taught. A final project involves design and implementation of a secure product. Prerequisite: ITM 411.
(3-0-3)

ITM 519
Topics in Software Development
This course will cover a particular topic, varying from semester to semester, in which there is particular student or staff interest. Prerequisite: consent of instructor (Credit: variable) This course may be taken more than once but only 9 hours of ITM 519 credit may be applied to a degree.
(Credit: Variable)

ITM 521
Client Server Applications and Technologies
This course covers both concepts and practical applications of client server systems, a common form of distributed system in which software is split between server tasks and client tasks. Both central and distributed server models will be studied, with particular focus on middleware, systems planning, and data access. The course includes hands-on development of client-server applications in database systems. Prerequisite: ITM 421.
(2-2-3)

ITM 526
Data Warehousing
This class will introduce the student to concepts needed for successfully designing, building and implementing a data warehouse. The class will provide the technological and managerial knowledge base for data modeling approaches such as the star schema and database de-normalization issues. Topics such as loading the warehouse, performance considerations, and other concepts unique to the data warehouse environment will be discussed and demonstrated in detail. Prerequisite: ITM 421.
(3-0-3)

ITM 527
Data Analytics I
This is a handson course that focuses on the creation, maintenance, and analysis of large financial and business databases including concepts such as simulated equities, insurance, and banking database systems. The student is expected to have a working understanding of relational database concepts as well as SQL. Prerequisite: ITM 422 or permission of instructor.
(3-0-3)

ITM 528
Database Security
Students will engage in an in-depth examination of topics in data security including security considerations in applications & systems development, encryption methods, cryptography law and security architecture & models. Prerequisite: ITM 421.
(3-0-3)

ITM 529
Advanced Data Analytics
solve problems in other fields. Informaticists use technology and information to build intelligent systems used to bridge the gaps between information, technology, and the people who use it. The study of Informatics is about blending applied mathematics with technology while understanding the broader consequences of computing on society and the problem being solved. It is important for any student to develop a broad perspective of technology and the people it serves. This course builds upon the student's knowledge of mathematical concepts of predictive modeling of samples and populations with an emphasis on applying technology to solve real world problems. Prerequisite: ITM 527 or permission of instructor.
(3-0-3)

ITM 531
Object-Oriented System Analysis, Modeling, and Design
This course will cover object oriented approaches to system analysis, data modeling and design that combine both process and data views of systems. Emphasis is given to practical problems and the techniques needed to create solutions in systems design.
(3-0-3)

ITM 532
UML Based Software Development
Study of software development using the Unified Modeling Language (UML). Covers architecture-driven and component based techniques for modeling object-oriented applications. Particular emphasis is placed on the hands on application of tools and components used for object oriented systems modeling. Prerequisite: ITM 412 or significant object-oriented programming experience.
(3-0-3)

ITM 533
Operating System Design and Implementation
This course introduces students to the fundamental principles of operating systems design, and gives them hands-on experience with real operating systems installation, design and implementation. The students apply what they learned about operating systems design to practical implementation, by modifying and extending the MINIX Operating System, MS Windows XP and LINUX are briefly discussed as case studies.
(3-0-3)

ITM 534
Human-Computer Interaction
Introduction to human-computer interaction, a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use. Emphasis is given to the structure of communication between people and computers, capabilities of people to use computers, concerns that arise in designing and building interfaces, design tradeoffs, and the process of specification, design, and implementation of user interfaces. Particular emphasis is placed on practical design and usability of computer system user interfaces.
(3-0-3)

ITM 535
Data Center Architecture
The course deals with building integrated data center information infrastructures, including facility, hardware, software and network components, as solutions to particular enterprise information management needs and requirements. Students will learn critical elements of modern data center design including physical plant construction; network infrastructure; data storage technologies; power provisioning and conditioning; environmental controls and HVAC; system and physical security; modular component use; and planning for growth. Prerequisites: ITM 540 and ITM 554.
(3-0-3)

ITM 536
Software Testing and Maintenance
This course covers the basic concepts of software testing and maintenance. The Testing Maturity Model provides a framework for developing a more mature test process. Testing techniques, test metrics and test plan management concepts are described within this framework. Prerequisites: ITM 471 or ITM 571.
(3-0-3)

ITM 537
Instructional Technologies
In this course students will create, assess, and deploy current technologies used for K-College instruction and corporate training environments. Topics covered include developing training materials, courses, individualized instruction, websites, multimedia projects, and online instruction in educational settings. Focus will be given to modern programming environments and models for developing instructional materials.
(3-0-3)

ITM 538
Computer Network Forensics
This course will address methods to properly conduct a computer and/or network forensics investigation including digital evidence collection and evaluation and legal issues involved in network forensics. Technical issues in acquiring court-admissible chains-ofevidence using various forensic tools that reconstruct criminally liable actions at the physical and logical levels are also addressed. Technical topics covered include detailed analysis of hard disks, files systems (including FAT, NTFS and EXT) and removable storage media; mechanisms for hiding and detecting hidden information; and the hands-on use of powerful forensic analysis tools.
(2-2-3)

ITM 539
Steganography
Digital steganography is the science of hiding covert information in otherwise innocent carrier files so that the observer is unaware that hidden infor-mation exists. This course studies both digital steganography and digital steganalysis (the science of discovering the existence of and extracting the covert information). In addition to understanding the science and the pathologies of specific carriers and hiding algorithms, students will have hands-on experience with tools to both hide and extract information. Carrier files such as image, audio and video files will be investigated. Prerequisite: ITM 538.
(2-2-3)

ITM 540
Introduction to Data Networks and the Internet
This course covers current and evolving data network technologies, protocols, network components, and the networks that use them, focusing on the Internet and related LANs. The state of worldwide networking and its evolution will be discussed. This course covers the Internet architecture, organization, and protocols in-cluding Ethernet, 802.11, routing, the TCP/UDP/IP suite, DNS, Bluetooth, SNMP, DHCP, and more. Students will be presented with Internet-specific networking tools for searching, testing, debugging, and configuring networks and networkconnected host computers. There will be opportunities for network configuration and hands-on use of tools.
(2-2-3)

ITM 541
Network Administration and Operations
Students learn the details, use, and configuration of network applications. Currently protocols and application technologies considered include SNMP, SMTP, IMAP, POP, MIME, BOOTP, DHCP, SAMBA, NFS, AFS, X, HTTP, DNS, NetBIOS, and CIFS/SMB. Windows workgroups and domains: file and printer sharing, remote access, and Windows networking are addressed. A research paper in the above topic areas is required. Prerequisite: ITM 440 or ITM 540.
(2-2-3)

ITM 542
Wireless Technologies and Applications
This course will present the foundation of wireless technologies and examine state-of-the-art wireless systems and services, including digital cellular systems (DCS), wireless asynchronous transfer mode (ATM), infrared data transfer (IrDA), wireless local area network technologies including 802.11a/b/g (wireless Ethernet) and Bluetooth, and thirdgeneration (3G) systems such as wireless code division multiple access (W-CDMA) and cdma2000. Security for wireless systems including encryption and authentication issues will also be addressed. Prerequisite: ITM 441 or ITM 541.
(3-0-3)

ITM 543
Vulnerability Analysis and Control
ethical hacking, penetration testing, detection of malicious probes and their prevention. It provides students with in-depth theoretical and practical knowledge of the vulnerabilities of networks of computers including the networks themselves, operating systems and important applications. Integrated with the lectures are laboratories focusing on use of open source and freeware tools; students will learn in a closed environment to probe, penetrate and hack other net-works. Prerequisite: ITM 440.
(2-2-3)

ITM 544
Cloud Computing Technologies
Computing applications hosted on dynamicallyscaled, virtual resources available as services are considered. Collaborative and noncollaborative "cloudresiden" applications are analyzed with respect to cost, device/location independence, scalability, reliability, security, and sustainability. Commercial and local cloud architectures are examined. A groupbased integration of course topics will result in a project employing various cloud computing technologies. Prerequisites: ITM 301 and ITM 311.
(2-2-3)

ITM 545
Telecommunications Technology
Introduction to voice and data communications infrastructure design and implementation. Current infrastructure including components of voice networks (such as carrier switches, PBXs, SS7, T1 trunks, and switched versus dedicated circuits), the Public Switched Telephone Network (PSTN), communications industry structure, telephone-data system interfaces and interaction, and convergence of voice and data communications systems will be examined, along with possible alternative approaches. Also examined will be components of data networks such as modems, multiplexers, virtual circuits, hubs, bridges, and routers and their relationships to voice communication systems. Future directions in the evolution of voice and data communications technology will be highlighted.
(3-0-3)

ITM 546
Telecommunications over Data Networks
This course covers a suite of application protocols known as Voice over IP (VoIP). It describes important protocols within that suite including RTP, SDP, MGCP and SIP and the architecture of various VoIP installations in-cluding on-net to on-net, on-net to PSTN and Inter-domain scenarios. The functions of the Network Elements that play significant roles in this architecture will be defined. Ex-amples of network elements that are currently available as products will be examined. Prerequisite: ITM 440 or ITM 540.
(3-0-3)

ITM 547
Telecommunications over Data Networks: Projects and Advanced Methods
Students create projects that exercise and expand their understanding of digital voice communication protocols, features and architectures. Instructional materials and lectures are provided as needed to support projects. These projects will develop a digital voice application or feature, or test a current digital voice product and architecture. Scope and deliverables will be determined through joint decision of the instructor and students. Students will describe requirements, create test plans as needed, demonstrate the operation when applicable, create a written description of the work and deliver a formal presentation to an audience appropriate to the scope and scale of the work completed. Prerequisite: ITM 546.
(3-0-3)

ITM 548
System and Network Security
Prepares students for a role as a network security administrator and analyst. Topics include viruses, worms, other attack mechanisms, vulnerabilities and countermeasures, network security protocols, encryption, identity and authentication, scanning, fire-walls, security tools, and organizations addressing security. A component of this course is a self-contained team project that, if the student wishes, can be extended into a fully operational security system in a follow-on course. Prerequisite: ITM 440 or ITM 540.
(2-2-3)

ITM 549
Systems and Network Security: Projects and Advanced Methods
Prepares students for a role as a network security analyst and developer and give the student experience in developing a production security sys-tem. Topics may include computer and network forensics, advances in cryptography and security protocols and systems; operating system security, analysis of recent security attacks, vulnerability and intrusion detection, incident analysis, and the design and development of secure networks. This course includes a significant real world team project the results in an fully operational security system. Students should have previous experience with object-oriented and/or scripting languages. Prerequisite: ITM 448 or ITM 548. (C)
(2-2-3)

ITM 551
Distributed Workstation System Administration
Students learn to set up and maintain PC workstations and servers and to administer PC servers and networks. Topics include hardware requirements; software compatibility; and system installation, configuration and options and post-installation topics; administrative practices required for file system security; process management; performance monitoring and tuning; storage management; back-up and restoration of data; and disaster recovery and prevention. A group project or research paper will demonstrate mastery of the subject. Prerequisite: ITM 301.
(4-4-6)

ITM 552
Client Server System Administration
Students learn to setup and configure a contemporary operating system, including the actual installation of the operating system on the student workstation, in a networked client-server environment. User account management, security, printing, disk configuration, and backup procedures are addressed, with particular attention to coverage of TCP/IP and TCP/IP applications. System installation, configuration and administration issues as well as network file systems, network access and compatibility with other operating systems are also addressed. A group project or research paper will demonstrate mastery of the subject. Prerequisite: ITM 302.
(4-4-6)

ITM 554
Operating System Virtualization
This course will cover technologies allowing multiple instances of operating systems to be run on a single physical system. Concepts addressed will include hypervisors, virtual machines, paravirtualization and virtual appliances. Both server and desktop virtualization will be examined in detail, with brief coverage of storage virtualization and application virtualization. Business benefits, business cases and security implications of virtualization will be discussed. Extensive hands-on assignments and a group project will allow students to gain first-hand experience of this technology. Prerequisite: ITM 301 or ITM 302 or permission of instructor.
(2-2-3)

ITM 555
Intelligent Device Applications
Intelligent device application development is covered with various technologies on mobile and robotic platforms. Utilizing contemporary toolkits, the student considers design and development on emulated and real "smart" devices including smart phones, personal digital assistants, sensors, actuators and robots. Numerous exercises reinforce concepts gained throughout the course. A term project will integrate course topics into a comprehensive intelligent device application. Prerequisite: ITM 311.
(2-2-3)

ITM 556
Intelligent Device Projects
Students create projects that exercise and expand their understanding of intelligent device application development. Instructional materials and lectures are provided as needed to support projects. Scope and deliverables will be determined through joint decision of the instructor and students. Students will describe requirements, create test plans as needed, demonstrate the application when applicable, create a written description of the work and may deliver a formal presentation to an audience appropriate to the scope and scale of the work completed. Prerequisite: ITM 555.
(2-2-3)

ITM 558
Operating System Security
This course will address theoretical concepts of operating system security, security architectures of current operating systems, and details of security implementation using best practices to configure operating systems to industry security standards. Server configuration, system-level firewalls, file system security, logging, anti-virus and anti-spyware measures and other operating system security strategies will be examined. Prerequisite: ITM 301 or ITM 302.
(2-2-3)

ITM 562
Website Application Develoment
Programming the Common Gateway Interface (CGI) for Web pages is introduced with emphasis on creation of interfaces to handle Webbased form data. CGI programming is taught in multiple languages. Security of Web sites is covered with an emphasis on controlled access sites. Setup, administration and customization of content management systems including blog and portal sites is introduced. Students design and create a major Web site with including basic CGI programs with Web interfaces and proc-ess data flows from online forms with basic database structures. Prerequisite: ITM 461.
(2-2-3)

ITM 564
Advanced Web Site Application Development
Strategies for management of electronic commerce allow students to learn to re-engineer established business processes to increase enterprise competitive advantage, provide better customer service, reduce operating costs, and achieve a better return on investment. Students will learn to evaluate, use, and deploy state-of-theart tools and techniques needed to develop a reliable e-commerce offering on the Web. The course will cover state-of-the-art programming and development tools. This class will provide students with hands-on exposure needed to design and build a fully functional e-commerce Web site. Prerequisite: ITM 562.
(2-2-3)

ITM 565
Rich Internet Applications
Students learn to create interactive rich Internet applications using Web development frameworks, applications and techniques that primarily operate on the clientside. These applications often exhibit the same characteristics as desktop applications and are typically delivered through a standardsbased Web browser, via a browser plugin, or independently via sandboxes or virtual machines. Current software frameworks used to download, update, verify and execute these applications are addressed, as well as writing applications for deployment in these frameworks.
(2-2-3)

ITM 566
Service-Oriented Architecture
This course covers IT enterprise systems employing web services technologies in SOA and ESB architectural patterns. The student considers SOA which defines and provisions IT infrastructure and allows for a loosely -coupled data exchange over disparate applications participating in business processes. The simplification of integration and flexible reuse of business components within SOA is greatly furthered by ESB. Lab exercises using contemporary toolkits are utilized to reinforce platform-agnostic course topics. Prerequisite: ITM 411 and ITM 461.
(2-2-3)

ITM 569
Topics in Application Development
This course will cover a particular topic, varying from semester to semester, in which there is particular student or staff interest. Prerequisite: consent of instructor. This course may be taken more than once but only 9 hours of ITM 569 credit may be applied to a degree.
(Credit: Variable)

ITM 571
Project Management for Information Technology Mangement
Basic principles of project management are taught. Includes software development concepts of requirements analysis, object modeling and design and software testing. Management of application development and major Web development projects will also be addressed.
(3-0-3)

ITM 572
Process Engineering for Information Technology Managers
This course will provide students with the knowledge and skills to define, model, measure and improve business processes. The course will focus on reengineering processes through the application of technology to achieve significant and measurable improvement. The course will explore the latest industry standards and students will use state-of-the-art software tools for hands-on experiential learning. Prerequisite: ITM 471 or ITM 571.
(3-0-3)

ITM 573
Building and Leading Effective Teams
This course will prepare students to be effective IT managers. Students will be introduced to the general challenges of management as well as the challenges unique to leading teams of technology professionals. The course will explore the skills necessary to excel as a leader including dealing with conflict, developing leadership skills, recruiting and developing employees, and leading remote and virtual teams. Students will explore case studies and execute team exercises to enrich their learning experience. Prerequisite: ITM 471 or ITM 571.
(3-0-3)

ITM 574
Information Technology Management Frameworks
This course will examine the application of industry standard frameworks to the management of information technology infrastructure, development and operations. Frameworks including the Information Technology Infrastructure Library (ITIL), Control Objectives for Information and related Technology (COBIT), and others will be covered. Students will learn to use these frameworks to tailor a set of concepts and policies to necessary manage IT in a specific enterprise.
(3-0-3)

ITM 575
Network and Telecommunications Management
This course addresses the design, implementation, and management of computer networks and enterprise telecommunication systems. Design issues in wide area networks and telecommunications with emphasis on Internet connectivity are also addressed. Tools for supporting the distribution and sharing of system resources and information are discussed, along with tools to support network design and management. Prerequisite: ITM 541.
(3-0-3)

ITM 576
Data Center Management
This course is an indepth examination of best practices in the management of enterprise data centers. Topics include data center consolidation; data center maintenance; server and network management methods and tools; budget and finance; service level agreements; managing data center personnel and staff; and disaster recovery. Prerequisite: ITM 535.
(3-0-3)

ITM 578
Information System Security Management
In-depth examination of topics in the management of information technology security including access control systems & methodology, business continuity & disaster recovery planning, legal issues in information system security, ethics, computer operations security, physical security and security architecture & models using current standards and models.
(3-0-3)

ITM 579
Topics in Information Security
This course will cover a particular topic, varying from semester to semester, in which there is particular student or staff interest. Prerequisite: consent of instructor. This course may be taken more than once but only 9 hours of ITM 569 credit may be applied to a degree.
(Credit: Variable)

ITM 581
IT Entrepreneurship
This course prepares students to become leaders in information technology and to build ITM companies. Students design and develop a prototype ITM product and prepare a business plan and venture proposal presentation.
(3-0-3)

ITM 582
Business Innovation
This course is designed to teach innovative thinking through theory, methods, and practice of innovation. The course incorporates Einsteins thinking, and Edisons method to establish the innovation process that can be applied in current business environment. Current economic conditions and global sourcing require that innovation become a leading tool for devel-oping a competitive edge. Innovation has been considered a competency of educated design engineering, and the selected few employees possessing this skill has become insufficient today. Corporations and organizations need innovation to develop customer-specific solutions in almost real time.
(3-0-3)

ITM 585
Legal and Ethical Issues in Information Technology
Current legal issues in information technology are addressed including elements of contracting, payment systems and digital signatures, privacy concerns, intellectual property, business torts and criminal liability including hacking, computer trespass and fraud. Examination of ethical issues including privacy, system abuse, and ethical practices in information technology equip students to make sound ethical choices and resolve legal and moral issues that arise in information technology.
(3-0-3)

ITM 586
Information Technology Auditing
Industry standard practices and standards in the auditing of information technology in an organization are addressed, with a particular emphasis on examination of IT governance, assets, controls and control techniques. Specific areas covered will include the audit process; IT governance; systems and infrastructure life cycle management; IT service delivery and support; protection of information assets; and business continuity and disaster recovery. Students will examine case studies and complete handson exercises.
(3-0-3)

ITM 588
Incident Response, Disaster Recovery, and Business Continuity
Students learn to design and manage key business information security functions including incident response plans and incident response teams; disaster recovery plans; business continuity plans; and crisis management teams and plans. Reporting, response planning and budgeting are all addressed. Students working in teams will prepare an incident response, disaster recovery, business continuity, or crisis management plan for a realworld organization such as a business or a government body or agency.
(3-0-3)

IT 593
Embedded Systems
This course introduces embedded systems concepts and technology, illustrates the trade-offs which occur as part of embedded systems design, as well as providing practical applications of embedded systems technology. Particular emphasis is given to embedded systems hardware, software and development tools. The course labs include hands-on development of several stand-alone embedded applications using development tools such as compilers, simulators and evaluation boards. Prerequisite: ITM 301 or equivalent computer architecture course; C/C++ programming experience.
(2-2-3)

ITM 594
Special Projects in Information Technology
Capstone project. Prerequisite: written consent of instructor.
(Credit : 1 to 6)

ITM 595
Topics in Information Technology
This course will cover a particular topic, varying from semester to semester, in which there is particular student or staff interest. Prerequisite: consent of instructor.
(Credit : Variable)

ITM 596
Gradate Honors Study in Information Technology
Graduate honors project, thesis or whitepaper. Prerequisites: Graduate Honors status and consent of instructor.
(Credit : Variable)

ITM 597
Special Problems in Information Technology
Independent study and project. Prerequisite: consent of instructor.
(Credit variable)

Undergraduate Courses Available to Graduate Students in Information Technology & Management as Prerequisites Only

ITM 301
Introduction to Contemporary Operating Systems and Hardware I

ITM 302
Introduction to Contemporary Operating Systems II

ITM 311
Introduction to Software Development

ITM 312
Introduction to Systems Software Program-ming

Intellectual Property Management and Markets

Program Director:
Jacqueline Leimer
312.906.5225
jleimer@kentlaw.edu

Knowledge and other intellectual assets are increasingly recognized as a driving force of innovation and economic growth. Intellectual property rights are becoming central to the modern economy. IIT's Master of Intellectual Property Management and Markets program (IPMM) was developed to respond to the need for highly qualified professionals for this important and fast-growing area.

The IPPM program provides a foundational understanding of intellectual property that integrates the perspectives and skills of five key disciplines: business, law, engineering, design, and computer science. Courses track the lifecycle of intellectual property from its inception to full exploitation. Graduates of this program will be equipped to take a strategic or leadership role leveraging and managing IP, whether through marketing, research and development, portfolio management, legal protection, or business transactions.

Degree Offered

Master of Intellectual Property Management and Markets

Degree Requirements

No thesis is required, but there is a capstone/project course requirement (2 credits). This course is an experiential learning opportunity that integrates the students' newly acquired knowledge, experiences and expertise. Students will create a global intellectual property strategy and plan for a company.

Department of Mathematics and Science Education

3424 S. State Street
Room 4007
Chicago, IL 60616
312.567.3661
312.567.3659 fax
ledermann@iit.edu
www.iit.edu/departments/msed

Chair:
N. G. Lederman

Director, Graduate Programs:
N. G. Lederman

Mathematics and science education is primarily concerned with all aspects of the teaching and learning of mathematics and/or science at the secondary levels (i.e., grades 6-12). The department offers Professional Masters, Master of Science, and Ph.D. degrees in mathematics and science education. The masters programs are specifically focused on experienced teachers, individuals seeking certification and advanced study, or individuals working in educational settings other than schools (e.g., museums, zoos, etc.). Specific attention is placed on curriculum development, evaluation, advanced instructional models, supervision, learning and cognition, and action research.

The Ph.D. programs are designed for those individuals wishing to become university-level teacher educators and researchers. Extensive attention is given to quantitative and qualitative research designs, along with advanced work in evaluation, curriculum analysis, and supervision. Both M.S. and Ph.D. students will be required to complete additional subject matter courses (e.g. science and mathematics) equivalent to 9-12 credit hours.

Degrees Offered

Master of Science in Mathematics Education
Master of Mathematics Education
Master of Science in Science Education
Master of Science Education
Doctor of Philosophy in Mathematics Education
Doctor of Philosophy in Science Education
Doctor of Philosophy in Collegiate Mathematics Education

Research Areas

Research areas include informal science/math education, curriculum development, integration of science/math disciplines and across disciplines, and instructional methods; students and teachers conceptions of scientific/mathematic inquiry and nature of science/math, instructional models, evaluation, and research design.

Faculty

Zaur Berkaliev, Assistant Professor of Mathematics Education. M.Sc., Moscow State University; Ph,D., Moscow State University; Ph.D., Indiana University. Curriculum development, student attitudes.

Catherine M. Koehler, Assistant Professor of Science Education. B.A., Central Connecticut State University; M.S., Central Connecticut State University; PhD, University of Connecticut.

Judith S. Lederman, Associate Professor of Science Education and Director of Teacher Education. B.A., Rhode Island College; M.S., Worcester Polytechnic Institute; Ph.D., Curtain University of Technology (Australia). Informal science education, curriculum development, integration of science disciplines and across disciplines, and instructional methods.

Norman G. Lederman, Professor and Chair, Mathematics and Science Education. B.S., Bradley University Biology; M.S. Bradley University Secondary Education; M.S., New York University, Biology; Ph.D., Syracuse University. Students and teachers conceptions of scientific inquiry and nature of science, instructional models, evaluation, and research design.

Daniel Z. Meyer, Assistant Professor of Science Education. B.A., Swartmore College; Ed.M., Harvard Graduate School of Education; Ph.D., Cornell University.

Martina Nieswandt, Associate Professor of Science Education. Ph.D., Christian-Albrechts University of Kiel-Germany. Motivation, affect and cognition in learning science in high schools; science teacher knowledge and beliefs; gender issues in SMT.

Stephanie R. Whitney, Assistant Professor of Mathematics Education. B.A., Gustavus Adolphus College; M.Ed, University of Minnesota; Ph.D., University of Minnesota.

Judith S. Zawojewski, Associate Professor of Mathematics Education. B.S.Ed., Northwestern University; M.S.Ed., National College of Education; Ph.D., Northwestern University. Teaching and learning of probability and statistics, evaluation and professional development.

Admission Requirements

Bachelor's (or Master's, for Ph.D. programs) degree in mathematics (for mathematics education), science (for science education) or another field with documented evidence of success in working with school-aged youth
GRE score minimum for M.S./Ph.D. applicants (for tests taken prior to Oct. 1, 2002): 1200 (combined) GRE score minimum for M.S. applicants (for tests taken on or after Oct. 1, 2002: 900 (quantitative + verbal) 2.5 (analytical writing))
GRE score minimum for Ph.D. applicants (for tests taken on or after Oct. 1, 2002: 1000 (quantitative + verbal) 3.0 (analytical writing))
TOEFL minimum 600/250/80* if from non-English speaking country
A minimum cumulative undergraduate GPA of 3.0/4.0
Two-page professional statement of goals/objectives
Curriculum Vita
Three letters of recommendation
An interview may be required

Additional requirements for Ph.D. programs: Three years of teaching experience. Meeting the minimum standards does not guarantee admission. Test scores and GPA are just two of several important factors considered, and admission decisions are made based upon the totality of the application file.

* Paper-based test score/computer-based test score/internet-based test scoe.

Master of Science in Mathematics Education (thesis)
Master of Mathematics Education (Professional Master's, non-thesis)

33 credit hours
Thesis (Master of Science) or non-thesis (Professional Master's) option

The objective of the master's programs is to provide practicing teachers, or individuals in education-related fields, with advanced education in the teaching and learning of mathematics. These advanced studies will enhance graduates' ability to provide meaningful instruction in mathematics; critically analyze and implement empirical research findings in mathematics education; develop and evaluate curriculum; and become a leader in public school education at the state or local levels.

Required courses
Core requirements

MSED 550 Clinical Supervision in Science/Mathematics
MSED 560 Research & Evaluation **OR**
MSED 552 Assessment and Evaluation
MSED 555 Middle & Secondary Mathematics Curriculum
PSYC 588 Learning, Cognition and Motivation **OR**
MSED 580 Adolescent Psychology
MSED 503 Advanced Strategies: Mathematics
MSED 540 Informal Education Practicum

Master of Science thesis option (Six Credits)

MSED 591 Thesis Research

Professional Masters non-thesis option (Three credits)

MSED 538 Inquiry & Problem Solving

And a minimum of three credits from the following:

MSED 571 Problem Solving and Nature of Mathematics
MSED 531 Professional Development and Practicum in Mathematics
MSED 562 Action Research

Nine credits of select coursework from discipline-specific mathematics courses

Master of Science in Science Education (thesis)
Master of Science Education (Professional Master's, non-thesis)

33 credits
Thesis (Master of Science) or non-thesis (Professional Master's)

The objective of the M.S. program is to provide practicing teachers, or individuals in education-related fields, with advanced education in the teaching and learning of science. These advanced studies will enhance graduates' ability to provide meaningful instruction in science; critically analyze and implement empirical research findings in science education; develop and evaluate curriculum; and become a leader in public school education at the state or local levels.

Required courses
Core requirements

MSED 550 Clinical Supervision in Science/Mathematics
MSED 560 Research and Evaluation **OR**
MSED 552 Assessment and Evaluation
MSED 554 Middle and Secondary Science Curriculum
PSYC 588 Learning, Cognition and Motivation **OR**
MSED 580 Adolescent Psychology
MSED 502 Advanced Strategies: Science
MSED 540 Informal Education Practicum

Master of Science thesis option (Six credits)

MSED 591 Thesis Research

Professional Master's non-thesis option: (Three credits)

MSED 538 Inquiry & Problem Solving

And a minimum of three credits from the following:

MSED 570 Inquiry and Nature of Science
MSED 530 Professional Development and Practicum in Science
MSED 562 Action Research

Nine credits of select coursework from discipline-specific mathematics courses

Master of Science/Mathematics Education

Teacher Certification Option
45 credit hours

The Master of Science/Mathematics Education (Teacher Certification Option) is designed for individuals who already possess a Bachelor's degree (preferably in an area of science or mathematics) and wish to pursue both a teaching certification and a Master's degree. This accelerated course of study allows the student to achieve certification and a Master's degree in just 45 credit hours instead of the 54 credit hours that would be required if certification and Master's degree were pursued separately.

Required Courses

MSED 500 Analysis of Classrooms II (Practicum and Seminar)
MSED 501/502 Advanced Strategies: Mathematics/Science
MSED 554/555 Middle and Secondary Science and Mathematics Curriculum
MSED 300 Instructional Methods/Strategies I
MSED 400 Instructional Methods/Strategies II
MSED 538 Inquiry & Problem Solving
MSED 540 Informal Education Practicum and Seminar
MSED 450 Professional Internship (6 credit hours)
MSED 550 Clinical Supervision in Science/Mathematics
MSED 552 Assessment and Evaluation
PSYC 588 Learning, Cognition, and Motivation **OR**
MSED 580 Adolescent Psychology

Nine credits from graduate level science/mathematics courses.
Total credits for this Masters option: 45

Doctor of Philosophy in Mathematics Education

84 credit hours (Minimum of 51 hours of coursework)
Qualifying exam within the first two years of Ph.D. study

Composed of five position statements (ranked by faculty)

Top three ranked must be defended orally and in writing.

Oral comprehensive exam with the students graduate committee (The dissertation proposal is presented orally as part of the comprehensive examination).
Oral dissertation defense, involving the final thesis exam

The objective of the Ph.D. program is to provide students with advanced education in the teaching and learning of mathematics. These advanced studies will enable graduates to conduct theoretical and practical research in mathematics education, develop and evaluate curriculum, prepare future teachers, provide professional development to in-service teachers, or become a leader in public school education at the state or local levels.

Core requirements (30 Credit Hours)

MSED 601 Critical Analysis in Quantitative Research
MSED 602 Quantitative Research Design and Practicum
MSED 603 Critical Analysis in Qualitative Research
MSED 604 Qualitative Research Design and Practicum
MSED 550 Clinical Supervision in Science/Mathematics
MSED 552 Assessment and Evaluation
MSED 555 Middle and Secondary Mathematics Curriculum
MSED 545 Statistics I
MSED 546 Statistics II
PSYC 588 Learning, Cognition and Motivation I **OR**
MSED 580 Adolescent Psychology

Elective requirements

(Minimum of nine credits)

MSED 501 Advanced Strategies: Math
MSED 531 Professional Development and Practicum in Mathematics
MSED 538 Inquiry and Problem Solving
MSED 540 Informal Education Practicum
MSED 560 Research & Evaluation
MSED 562 Action Research
MSED 571 Problem Solving and Nature of Mathematics
MSED 597 Special Problems (Ethics)
MSED 594 Special projects (Independent Studies within MSED)

Up to eight hours from discipline-specific graduate coursework
12 credits of select coursework from discipline-specific mathematics courses/related fields
Total minimum coursework: 51 credit hours

MSED 691 Ph.D. Thesis Research Minimum 25 hours

Total minimum credits: 84 credit hours
42 maximum transfer of graduate credits from masters (24 credits from coursework/eight credits from research)

Doctor of Philosophy in Science Education

84 credit hours (minimum 51 hours of coursework)
Qualifying exam within the first two years of Ph.D. study

Composed of five position statements (ranked by faculty)

Top three ranked must be defended orally and in writing.

Oral comprehensive exam with the students graduate committee (The dissertation proposal is presented orally as part of the comprehensive examination.)
Oral dissertation defense, involving the final thesis exam

The objective of the Ph.D. program is to provide students with advanced education in the teaching and learning of science. These advanced studies will enable graduates to conduct theoretical and practical research in science education; develop and evaluate curriculum; prepare future teachers; provide professional development to in-service teachers; or become a leader in public school education at the state or local levels.

Required courses

Core requirements (30 Credit Hours)

MSED 601 Critical Analysis in Quantitative Research
MSED 602 Quantitative Research Design and Practicum
MSED 603 Critical Analysis in Qualitative Research
MSED 604 Qualitative Research Design and Practicum
MSED 550 Clinical Supervision in Science/Mathematics
MSED 552 Assessment and Evaluation
MSED 554 Middle and Secondary Science Curriculum
MSED 545 Statistics I
MSED 546 Statistics II
PSYC 588 Learning, Cognition and Motivation I **OR**
MSED 580 Adolescent Psychology

Elective requirements

(Minimum of nine credits)

MSED 502 Advanced Strategies: Science
MSED 530 Professional Development and Practicum in Science
MSED 538 Inquiry and Problem Solving
MSED 540 Informal Education Practicum
MSED 562 Action Research
MSED 570 Inquiry and Nature of Science
MSED 597 Special Problems (Ethics)
MSED 594 Special Projects (Independent Studies within MSED)

Up to eight hours from discipline-specific graduate coursework
12 hours of select coursework from discipline-specific science courses/related fields
Total minimum coursework: 51 credit hours

MSED 691 Ph.D. Thesis Research Minimum of 25 credits

Total minimum credits: 84 credit hours
42 maximum transfer of graduate credits from masters (24 credits from coursework/eight credits from research)

Doctor of Philosophy in Collegiate Mathematics Education

85 credit hours beyond the bachelor's degree*
Qualifying exam
Comprehensive exam
Dissertation and Defense

This joint Ph.D. program is offered through the collaboration of the departments of Applied Mathematics (AM) and Mathematics and Science Education (MSED). The objective of the program is to provide advanced education in the teaching and learning of collegiate mathematics through coursework and original research. These advanced studies will enable graduates to teach a wide range of college level mathematics courses, conduct theoretical and practical research on collegiate mathematics teaching and learning, or develop and evaluate college mathematics curriculum.

AM Core Requirements (18 credit hours):

MATH 500 Applied Analysis I
MATH 553 Discrete Applied Mathematics I
MATH 577 Computational Mathematics I
MATH 515 Ordinary Differential Equations and Dynamical Systems
MATH 532 Linear Algebra
MATH 476 Statistics

MSED Core Requirements (18 credit hours):

MSED 598 Methods of College Teaching in Mathematics and Science
MSED 599 College Teaching Practicum in Mathematics and Science
MSED 601 Critical Analysis in Quantitative Research
MSED 602 Quantitative Research Design and Practicum
MSED 603 Critical Analysis in Qualitative Research
MSED 604 Qualitative Research Design and Practicum

AM Elective Requirements (minimum of 12 credits):

MATH 401 Analysis II
MATH 402 Complex Analysis
MATH 420 Geometry
MATH 475 Probability
MATH 5xy (any 500-level AM courses)

MSED Elective Requirements (minimum of 9 credits):

MSED 501 Advanced Strategies: Mathematics
MSED 550 Clinical Supervision in Science/Mathematics
MSED 552 Assessment and Evaluation
MSED 555 Mathematics Curriculum
MSED 571 Problem Solving and Nature of Mathematics

The qualifying exam is fulfilled by achieving better than a 3.5/4.0 GPA on the MATH 476, MATH 500, MATH 553, and MATH 577 AM core courses and a 3.5/4.0 GPA on the MSED 601, MSED 602, MSED 603, and MSED 604 MSED core courses and passing an oral examination within the first five semesters of Ph.D. study. The oral exam consists of two one-hour parts covering AM and MSED core courses respectively. For the AM part, the candidate selects any two out of the four above-mentioned AM core courses plus another one AM core course to be tested on during the oral exam. For the MSED part, the candidate proposes five position statements ranked by the faculty. The MSED oral exam is composed of the two position statements with the highest rankings. Position Statement 1: Written defense to support position with empirical research. Position Statements 2: Oral defense.

The comprehensive exam consists of an oral examination based on the student's research proposal. The exam aims to ensure that the student has the background to carry out successful research in his/her chosen area and the proposed research has sufficient scholarly merit.

The minimum of 25 hours should be devoted to thesis research (CMED 691). The dissertation (thesis) is expected to contain a distinct and substantial, original and publishable contribution to the field of study. An oral examination in defense of the thesis constitutes completion of the degree.

(*) 32 credits maximum transfer from master's coursework; 42 maximum transfer of graduate coursework credits; the number of subjects allowed for transfer credit depends on what subject have been recently taken and is decided on a case-by-case basis

Admission Criteria: Admission to the joint Ph.D. program in collegiate mathematics education requires:

- Master's or Bachelor's Degree in mathematics or applied mathematics. Candidates whose degree is in another related field (for example, computer science, physics, or engineering) and whose background in mathematics is strong are also eligible for admission and are encouraged to apply.
- Quantitative and Verbal score: 1100
- Analytical score: 3.0
- TOEFL (minimum score of 600 for paper-based, 250 for computer-based, and 100 for internet-based test) if from non-English speaking country
- A minimum GPA of 3.0/4.0 is required
- Professional statement of goals/objectives (2 pages)
- Vita
- Three letters of recommendation
- An interview may be required

Course Descriptions

Numbers in parentheses represent class hours, lab hours, and total credit hours, respectively.

MSED 500
Analysis of Classrooms II
This course includes a two-hour seminar on campus each week, along with approximately five hours per week in an area school. This is an introductory course that provides students background teaching theory, classroom management, aspects of effective teaching, critical classroom variables, and the school as a system.
(2-5-3)

MSED 501
Advanced Strategies: Math
A course that provides additional exposureand development of instructional strategies and models of mathematics teaching. Special emphasis is placed upon promoting critical thinking and decision making.
(3-0-3)

MSED 502
Advanced Strategies: Science
A course that provides additional exposure and development of instructional strategies and models of science teaching. Special emphasis is placed upon promoting critical thinking and decision making.
(3-0-3)

MSED 509
Instructional Strategies for Middle School Mathematics
Instructional Strategies for Middle School Mathematics specifically addresses concerns of teaching grades 5-8 mathematics by considering the social and psychological characteristics of students in transition from elementary to high school mathematics. The course uses a focus on rational number and proportional reasoning (topics that span the middle school curriculum) to study students development of powerful representational systems and conceptual flexibility. Participants will learn about building mathematical community in which students construct mathematical evidence for claims of perceived regularities and patterns on logical reasoning and mathematical thinking. Participants will select, adapt and design worthwhile mathematical tasks to serve various instructional purposes. Finally, the participants will learn what it means to build an on-going assessment system that integrates self-, peer-, teacher-, formative and summative assessment into a system of best practice that blurs the line between learning and assessment.
(3-0-3)

MSED 510
Problem-Based Algebra
Algebra is taught via a problem solving approach with connections to other topic areas such as geometry, statistics and probability. Explorations with and conjecturing about number relationships and functions provide experiences from which students develop algebraic habits of mind: Doing and undoing (algebraic thinking that involves reflective or reverse algebraic reasoning, doing problems/procedures backwards); building rules to represent functions (recognizing patterns and organizing data to representation situations in which input is related to output by well-defined functional rules); and abstracting from computation (developing the capacity to think about computations independently of particular numbers used).
(3-0-3)

MSED 511
Problem-Based Number Theory
Number theory is taught via a problem solving approach with connections to geometry, logic, and probability. Explorations with and conjecturing about number patterns provide experiences from which students study various topics including: factors, primes, and prime factorization; counting techniques; greatest common factor (GCF) and least common multiple (LCM); divisibility; number patterns (e.g., Pascal's triangle, polygonal numbers, Pythagorean triples; Fibonacci numbers); Diophantine equations; remainder classes and modular arithmetic; iteration, recursion, and mathematical induction.
(3-0-3)

MSED 512
Problems in the Philosophy of Science
This course looks at some key issues in the philosophy and history of science, including the rationality of science, the role of values in scientific inquiry, and the use of models and analogies in scientific thinking. Given that experiments and observations alone never suffice to determine theory choice, we seek to understand the values that invluence science and investigate how it is that science can make progress. We build towards a picture of science as a social process in which theoretical models are chosen and developed in such a way as to increase our over-all ability to solve important problems.
(3-0-3)

MSED 513
Problem-Based Statistics and Probability
This course emphasizes statistics and probability as practical subjects devoted to obtaining and processing data with a view toward making statements that often extend beyond the data. These statements (i.e., inferences) take the form of estimates, confidence intervals, significance tests, etc. The content of this course is concerned with the production of good data, and involves consideration of experimental designs and sample surveys. The activities have their origin in real data and are concerned with processing the data in the widest contexts and with a wide variety of applications such as social, administrative, medical, the physical sciences and the biological sciences.
(3-0-3)

MSED 514
Problem-Based Geometry
Geometry is taught via problem solving with connections to other topic areas such as algebra and number theory. Participants use Geometers Sketchpad to investigate about fundamental concepts of Euclidean geometry in two and three dimensions and their applications. Explorations of and conjecturing about these concepts provide experiences from which students study various topics including: properties and relationships of geometric objects; geometric proof; area and volume; transformations, symmetry and tessellations; trigonometric ratios; and visual modeling of algebraic operations and abstract algebraic concepts.
(3-0-3)

MSED 515
Physical Science Research: Practicum I
The purpose of this course is to provide a comprehensive, immerse experience in scientific research for current and prospective K-12 science teachers. It is intended as the first in a two course sequence. In this course, students will begin by having a module covering key concepts in the sociology of science. The bulk of student work will be to participate in a laboratory placement. Prerequisite: admission into the Physical Science Initiative Cohort program or approval of the instructor.
(3-0-3)

MSED 517
Problem-Based Foundations of Calculus
The course is focused on the development of foundational ideas, concepts, and methods of introductory calculus and its basic applications with emphasis on various problem-solving strategies, visualization, mathematical modeling, and connections to algebra, geometry, number theory, and logic relevant to the middle school mathematics curriculum. Explorations with the SimCalc software and conjecturing about linking graphs, tables, and concrete to represent dynamic situations provide experiences from which students study various topics including: linear, quadratic, cubic, exponential, logarithmic, and trigonometric functions and their graphs; limits and continuity; rate of change, slope, tangent, and derivative; area under a curve and integration; elements of infinite series.
(3-0-3)

MSED 520
Geometry
This course is focused on selected topics related to fundamental concepts and methods of Euclidean geometry in two and three dimensions and their applications with emphasis on various problemsolving strategies, geometric proof, visualization, and interrelation of different areas of mathematics. Consent of instructor.
(3-0-3)

MSED 521
Perspectives in Analysis
This course is focused on selected topics related to fundamental concepts and methods of classic analysis and their applications with emphasis on various problem-solving strategies, visualization, mathematical modeling, and interrelation of different areas of mathematics. Consent of instructor.
(3-0-3)

MSED 523
City Science - Environmental Science
City Science is developed to help teachers increase their content knowledge of city ecology, human impact on the environment, engineering, and city infrastructure. This course explores how to further the interaction of inquiry based teaching methods into the classroom, as well as the multiple ways that an informal institution, MSI (Museum of Science and Industry), can be used to further the classroom objectives established. Teachers will discuss science content and practice inquiry based classroom activities that address the following key ideas: ecosystems, habitats, food chain, engineering, forces, load, tension, compression, and gravity.
(6-0-6)

MSED 524
Physical Science - Get Energized
Get Energized is designed to help teachers become more proficient in key physical science concepts related to energy. Teachers can increase their comfort level in teaching energy related topics such as light, mechanical, heat, sound, and electrical. Each full day workshop focuses on a particular energy topic and explores how that topic can be brought back to the classroom in an engaging way. This program also explores how to further the interaction of inquiry based teaching methods into the classroom, as well as the multiple ways that an informal institution, MSI (Museum of Science and Industry) can be used to further the curriculum ojectives established. Major topics include: energy transformation, potential and kinetic energy, mechanical energy, electrical energy, sound, thermal, and light energy.
(6-0-6)

MSED 525
Life Science - All About You
All About You focuses on life science, particularly the science of the human body. The course is designed tohelp teachers learn to utilize inquiry based and hands-on/minds-on science curriculum both within and outside of the classroom setting. Through this intensive and engaging year-long program, the workshops focus on expanding science teachers' capacity by building their content knowledge and enhancing their instructional practice. Aside from this program being broad based and interdisciplinary, this program explores how to further the interaction of inquiry based teaching methods into the classroom, as well as the multiple ways that an informal institution such as the Museum of Science and Industry (MSI) can be used to further the curriculum objectives established. Major topics include: cells, tissues and organs, genetics and evolution, body systems, and health and wellness.
(6-0-6)

MSED 530
Teacher Education/Professional Development in Science
A course that stresses the empirical research on best practices in teacher education and professional development in science.
(3-0-3)

MSED 531
Teacher Education/Professional Development in Mathematics
A course that stresses the empirical research on best practices in teacher education and professional development in mathematics.
(3-0-3)

MSED 538
Inquiry and Problem Solving
Developing a functional understanding of the nature of science and general math problem solving in the context of scientific inquiry.
(3-0-3)

MSED 540
Informal Education Practicum
Placement in an informal educational setting such as museums and outdoor education. The focus of this course is on the use of informal setting to supplement classroom instruction.
(3-0-3)

MSED 545
Statistics for Educators I
Part one of a two part course. This course provides concepts and methods of gathering, describing and drawing conclusions from data. Statistical reasoning, probability, sampling, regression, correlation, forecasting, nonparametric statistics, conceptions and misconceptions about statistics, problem solving techniques and current research are included throughout the course.
(3-0-3)

MSED 546
Statistics for Educators II
Part two of a two part course. Statistical reasoning, probability, sampling, regression, correlation, forecasting, nonparametric statistics, conceptions and misconceptions about statistics, problem solving techniques and current research are included throughout the course.
(3-0-3)

MSED 550
Clinical Supervision in Science/Mathematics
Provides for the development of a variety of classroom observation techniques and clinical supervision skills.
(3-0-3)

MSED 552
Assessment and Evaluation
Contemporary assessment and evaluation theory and the development of valid cognitive, affective, and psychomotor assessment items/tasks. In-depth attention is given to the development and scoring of alternative assessment techniques such as portfolios and projects.
(3-0-3)

MSED 554
Middle and Secondary Science Curriculum
Current trends, history of these trends, and rationale for science curriculum reform.
(3-0-3)

MSED 555
Middle and Secondary Mathematics Curriculum
Current trends, history of these trends, and rationale for mathematics curriculum reform.
(3-0-3)

MSED 560
Research and Evaluation
Analysis of qualitative and quantitative empirical research in science and mathematics education.
(3-0-3)

MSED 562
Action Research
Reviewing, designing and conducting research studies within the context of the students' own teaching.
(3-0-3)

MSED 571
Problem Solving and Nature of Mathematics
Developing a functional understanding of the nature of mathematics in the context of problem solving.
(3-0-3)

MSED 573
City Science - Environmental Science
City Science is developed to help teachers increase their content knowledge of city ecology, human impact on the environment, engineering, and city infrastructure. This course explores how to further the interaction of inquiry based teaching methods into the classroom as wel as the multiple ways that an informal institution, MSI (the Museum of Science and Industry), can be used to further the classroom objectives established. Teachers will discuss science content and practice inquiry based classroom activities that address the following key ideas: ecosystems, habitats, food chain, engineering, forces, load, tension, compression, and gravity. This course is condensed and offered in the summer semester only.
(3-0-3)

MSED 574
Physical Science - Get Energized
Get Energized is designed to help teachers become more proficient in key physical science concepts relaed to energy. Teachers can increase their comfort level in teaching energy related topics such as light, mechanical, heat, sound, and electrical. Each full day workshop focuses on a particular energy topic and explores how that topic can be brought back to the classroom in an engaging way. This program also explores how to further the interaction of inquiry based teaching methods into the classroom as well as the multiple ways that an informal institution, MSI (Museum of Science and Industry) can be used to further the curriculum ojectives established. Major topics include: energy transformation, potential and kinetic energy, mechanical energy, electrical energy, sound, thermal, and light energy. This course is condensed and offered in the summer semester only.
(3-0-3)

MSED 575
Life Science - All About You
All About You focuses on life science, particularly the science of the human body. The course is designed to help teachers learn to utilize inquiry based and hands-on/minds-on science curriculum both within and outside of the classroom setting. The workshops focus on expanding science teachers' capacity by building their content knowledge and enhancing their instructional practice. Aside from this program being broad based and interdisciplinary, this program explores how to further the interaction of inquiry based teaching methods into the classroom, as well as the multiple ways that an informal institution such as the Museum of Science and Industry (MSI) can be used to further the curriculum objectives established. Major topics include: cells, tissues and organs, genetics and evolution, body systems, and health and wellness. This course is condensed and offered in the summer semester only.
(3-0-3)

MSED 580
Adolescent Psychology
This course is designed to develop the participants' understanding of adolescent psychology. The main foci throughout the course are the unique aspects of adolescents and how those aspects influence behavior, learning, and social interactions, especially with regard to middle schools. Studies will include educational psychology theories and models, motivation and learning, developmental changes during adolescence, cognitive abilities, human ecology, diversity, and cultures. Additionally, participants will examine historical and philosophical perspectives of adolescent psychology and synthesize how these perspectives have influenced teaching, learning, and cultures in middle schools. The course will involve weekly readings and reflections, classroom experiences, short assignments, tests/quizzes, research projects, and formal class presentations.
(3-0-3)

MSED 591
Research and Thesis for MS
(6-0-6)

MSED 594
Special Projects
Advanced projects involving independent study, and especially fieldwork and modeling projects.
(Credit: Variable 1-6)

MSED 597
Special Problems
Independent Study and Project.
(Credit: Variable 1-9)

MSED 598
Methods of College Teaching in Math and Science
The course is designed to allow each student to develop theoretical background, practical knowledge and skills for successful college level mathematics or science teaching. Specific emphasis will be placed upon instructional methods/models, strategies/models curriculum development and instructional planning.
(3-0-3)

MSED 599
College Teaching Practicum
The purpose of the course is to enhance college level teacher preparation with an advanced learning experience joining together theory and practice. This course provides the student the opportunity to practice and improve knowledge and skills at teaching. The student may actively participate or act as an observer at a different college(s). In addition, students are required to prepare a Portfolio. The portfolio provides the student the opportunity to demonstrate a readiness for teaching that describes their efforts and progress in preparing to teach science or mathematics at the college level.
(0-3-3)

MSED 601
Critical Analysis in Quantitative Research
A study of quantitative research designs and analytical procedures with critical analysis of perspectives of research in science/mathematics education.
(3-0-3)

MSED 602
Quantitative Research Design and Practicum
A study of quantitative research designs, analytical procedures, and in-depth analysis with specific applications in science/mathematics education.
(3-0-3)

MSED 603
Critical Analysis in Qualitative Researc
A study of qualitative research designs and analytical procedures with critical analysis of perspectives of research in science/mathematics education.
(3-0-3)

MSED 604
Qualitative Research Design and Practicum
A study of qualitative research designs, analytical procedures, and in-depth analysis with specific applications in science/mathematics education.
(3-0-3)

MSED 691
PhD. Thesis Research
(Variable: 1-20)

Department of Mechanical, Materials, and Aerospace Engineering

243 Engineering 1 Building
10 W. 32nd St.
Chicago, IL 60616
312.567.3175
dept@mmae.iit.edu
www.mmae.iit.edu

Chair:
Jamal Yagoobi

Associate Chair, Graduate Programs:
Kevin Cassel

The Department of Mechanical, Materials and Aerospace Engineering offers several flexible programs in mechanical and aerospace engineering, with five major areas of study: computer-aided design and manufacturing, dynamics and control, fluid dynamics, solids and structures, and thermal sciences. The department also offers programs in materials science and engineering and manufacturing engineering.

Degrees Offered

Master of Mechanical and Aerospace Engineering
Master of Materials Science and Engineering
Master of Manufacturing Engineering
Master of Science in Mechanical and Aerospace Engineering
Master of Science in Materials Science and Engineering
Master of Science in Manufacturing Engineering
Doctor of Philosophy in Mechanical and Aerospace Engineering
Doctor of Philosophy in Materials Science and Engineering

Interdisciplinary Programs

With the Department of Chemical and Biological Engineering and the Department of Electrical and Computer Engineering:

Master of Science in Mechanical and Aerospace Engineering (with specialization in Energy/Environment/Economics (E^3))
Master of Mechanical and Aerospace Enginering (with specialization in Energy/Environment/Economics (E^3))

Certificate Programs

Computer Integrated Design and Manufacturing
Product Quality and Reliability Assurance

Research Centers

Fluid Dynamics Research Center (fdrc.iit.edu)
Thermal Processing Technology Center (tptc.iit.edu)

Research Facilities

Mechanical and aerospace engineering laboratories include the Fejer Unsteady Wind Tunnel; the Morkovin Low-Turbulence Wind Tunnel; the National Diagnostic Facility, a computer-controlled, high-speed, subsonic flow wind tunnel; a high-speed jet facility for aeroacoustic research; a hydrodynamics laboratory; flow visualization systems; laser-based measuring equipment and manufacturing; several computer-based data acquisition, processing and display systems of the Fluid Dynamics Research Center; laboratories in experimental mechanics; laboratories for research in robotics, guidance and navigation, computer integrated manufacturing, Footlik CAD lab, biomechanics and its instrumentation, combustion, internal combustion engines, two-phase flow and heat-transfer, electrohydrodynamics, and combined heat and mass transfer; and research facilities for atomization, spray flames, and emissions from mobile and stationary combustion sources.

Materials science and engineering laboratories include facilities for research in metallography, heat treatment, and mechanical testing; optical, scanning and transmission electron microscopes; powder metallurgy, and laser machining facilities. The department has numerous computers and workstations available for computational research activities.

Research Areas

The faculty conducts research activities in fluid dynamics, including aeroacoustics, flow control, turbulent flows, unsteady and separated flows, instabilities and transition, turbulence modeling, flow visualization techniques, computational fluid dynamics; metallurgical and materials engineering, including microstructural characterization, physical metallurgy of ferrous and nonferrous alloys, powder materials, laser processing and machining, high temperature structural materials, mechanical behavior, fatigue and fracture, environmental fatigue and fracture, computational x-ray diffraction analysis, texture, recrystallization and computational methods in materials processing; solids and structures, including experimental mechanics of composites and cellular solids, high strain rate constitutive modeling and thermomechanical coupling, fracture mechanics, design and testing of prosthetic devices; computational mechanics, cable dynamics and analysis of inelastic solids; theoretical mechanics, including wave propagation, fracture, elasticity and models for scoliosis; computer added design and manufacturing, concentrated in the areas of computer-aided design, computer-based machine tool control, computer graphics in design, manufacturing processes, wear and fracture behavior of cutting tols, tribology, frictional wear characteristics of ceramics, dynamic systems and mechanical vibrations; thermal sciences, including phase change heat transfer, enhancement of heat transfer and mass transport in macro and micro scales, electrohydrodynamics, spray combustion, atomization, transport processes within gas-liquid and gas-solid dispersions and suspensions, alternative fuels, mobile and stationary source combustion emissions, and dynamics and control, including guidance, navigation, and control of aircraft and spacecraft, intelligent control for aircraft models, flow fields, robotics devices for laser machining; and dynamic analysis and control of complex systems.

Faculty

Hamid Arastoopour, Henry R. Linden Professor for Energy (Joint appointment with ChBE and MMAE); Director of the Wanger Institute for Sustainability and Energy Research. B.S., Abadan Institute of Technology (Iran); M.S. Illinois Institute of Technology, Ph.D., Illinois Institute of Technology. Transport phenomena of multiphase systems and fluidization, computational fluid dynamics (CFD), hydrogen storage, tire recycling, particle technology in applications to coal gasification, production of gas from unconventional gas reserves and hydrates, and energy sustainability issues.

Roberto Cammino, Lecturer. B.S., Illinois Institute of Technology; M.S., Illinois Institute of Technology; Ph.D., Illinois Institute of Technology. Fracture mechanics, finite element method.

Kevin W. Cassel, Associate Professor and Associate Chair for Graduate Programs. B.S., Messiah College; M.S., Ph.D., Lehigh University. Computational fluid dynamics, unsteady boundary-layer flows, buoyancy-driven flows, supersonic and hypersonic boundary-layer flows.

John C. Cesarone, Senior Lecturer. B.S., M.S., University of Illinois; Ph.D., Northwestern University. Robotics, reliability engineering and manufacturing.

Herek L. Clack, Associate Professor. B.S., Massachusetts Institute of Technology; M.S., Ph.D., University of California, Berkeley. Thermofluid systems: atomization, combustion, hazardous waste incineration, combustion emissions, heat/mass transfer and phase change, ultrasound and sonochemical materials processing.

Alan W. Cramb, Provost and Senior Vice President for Academic Affairs. B.Sc., University of Strathclyde, Glasgow, Scotland; Ph.D., University of Pennsylvania. Initial solidification behavior of steels, solidification behavior of liquid oxides, effect of inclusion chemistry on solidification behavior, clean steel production, initial solidification phenomenain a continuous casting mold.

Michael R. Gosz, Associate Professor and Associate Provost for Undergraduate Affairs. B.S., Marquette University; M.S., Ph.D., Northwestern University. Computational solid mechanics, fracture mechanics, interface effects in composite materials, modeling of composite structures subjected to thermal cycling, and nonlinear dynamic finite element analysis of submerged flexible structures.

John S. Kallend, Professor and Associate Dean, Armour College of Engineering. B.A., M.A., Ph.D., Cambridge University (England). Computational methods of crystallographic texture analysis and properties of polycrystalline aggregates.

Kevin P. Meade, Professor. B.S., M.S., Illinois Institute of Technology; Ph.D., Northwestern University. Solid mechanics, biomechanics, elasticity, fracture mechanics and computational mechanics.

Sheldon Mostovoy, Associate Professor. B.S., Ph.D., Illinois Institute of Technology. Metallurgy, mechanical properties of materials, fatigue and fracture.

Hassan M. Nagib, John T. Rettaliata Professor. B.S., M.S., Ph.D., Illinois Institute of Technology. Fluid dynamics, heat transfer, applied turbulence, wind engineering and aeroacoustics.

Sudhakar E. Nair, Professor and Associate Dean of Academic Affairs, Graduate College. B.Sc., Regional Engineering College (India); M.E., Indian Institute of Science (India); Ph.D., University of California, San Diego. Solid mechanics, stress analysis of composite and inelastic material, dynamics of cable, fracture mechanics and wave propagation theory.

Philip G. Nash, Professor and Director of the Thermal Processing Technology Center. B.S., City of London Polytechnic (England); Ph.D., Queen Mary College of London University (England). Physical metallurgy, intermetallics, powder metallurgy, composites, phase equilibria and transformations.

Aleksandar Ostrogorsky, Professor. Dipl. Ing, University of Belgrade (Serbia); M.S., Nuclear Engineering, Rensselaer Polytechnic Institute; Sc.D. Mechanical Engineering, Massachusetts Institute of Technology. Heat and mass transfer phenomena occurring in materials processing; Directional solidification/single crystal growth focusing on semiconductor alloys; Wide band gap materials for gamma ray detectors (semiconductors and scintillators); Diffusion, growth of carbon nanotubes.

Matthew Peet, Assistant Professor. B.S., University of Texas at Austin (Aerospace Engineering); B.S., University of Texas at Austin (Physics); M.S., Stanford University; Ph.D., Stanford University. Modeling and control of the human immune system and Leukemia. Decentralized control laws for large scale communication and power networks. Computational theory of parallel computing as applied to problems in control. Computational analysis and control of delayed and partial-differential systems. Theory and practice of optimizing polynomials for nonlinear control.

Boris Pervan, Professor. B.S., University of Notre Dame; M.S., California Institute of Technology; Ph.D., Stanford University. Dynamics, control, guidance and navigation.

Xiaoping Qian, Associate Professor. B.S., M.S. Huazhong University, PhD University of Michigan. 3D object digitization, design and manufacturing, heterogeneous object modeling, layered manufacturing.

Ganesh Raman, Associate Professor and Associate Dean for Research, Graduate College. B.Tech., Indian Institute of Technology (India); M.S., Cleveland State University; Ph.D., Case Western Reserve University. Experimental fluid mechanics, aeroacoustics, active flow control, jet screech, and fluidics.

Dietmar Rempfer, Associate Professor. M.S., Ph.D., Universitaet Stuttgart (Germany). Fluid mechanics, especially theoretical studies of transitional and turbulent shear flows in open systems, numerical fluid mechanics, coherent structures in turbulent flows, nonlinear dynamical systems.

Francisco Ruiz, Associate Professor and Associate Chair for Undergraduate Programs. B.S.M.E., Universidad Politecnica de Madrid (Spain); M.E., Ph.D., Carnegie-Mellon University. Combustion, atomization, pollution control of engines, fuel economy, alternative fuel, electronic cooling and special cooling.

Shawn Shadden, Assistant Professor. B.S., University of Texas at Austin; Ph.D., California Institute of Technology. Dynamical systems theory, transport and mixing, modeling mechanical systems, biological flows.

Matthew Spenko, Assistant Professor. B.S. Northwestern University; M.S., Ph.D., Massachusetts Institute of Technology. Robotics, design, dynamics, and controls.

Sammy Tin, Associate Professor. B.S. California Polytechnic State University; M.S. Carnegie Mellon University; PhD University of Michigan. Procesing and deformation characteristics of high-temperature structural materials, modeling the microstructure of Ni-base superalloy turbine disks during thermomechanical processing, understanding the mechanisms of creep and fatigue deformation in advanced high-refractory content single crystal turbine blades.

Murat Vural, Assistant Professor. B.S., M.S., Ph.D., Istanbul Technical University (Turkey). Experimental solid mechanics with emphasis on high-strain-rate mechanical response, thermomechanical coupling, failure characterization and constitutive modeling of homogeneous and heterogeneous materials.

Candace E. Wark, Professor. B.S., M.S., Michigan State University; Ph.D., Illinois Institute of Technology. Fluid dynamics, turbulence, digital data acquisition and processing.

David R. Williams, Professor and Director of the Fluid Dynamics Research Center. B.S.E., Stevens Institute of Technology; M.S.E., Ph.D., Princeton University. Experimental fluid mechanics with emphasis on flow measurement and flow control techniques.

Benxin Wu, Assistant Professor. B.E., Tsinghua University; M.S., University of Missouri-Rolla; Ph.D., Purdue University. Laser-matter interactions, laser applications in manufacturing, materials processing and other areas.

Jamal S. Yagoobi, Professor and Chair of Department. B.S., Sharif University of Technology (Iran); M.S., Ph.D., University of Illinois, Urbana-Champaign. Experimental and theoretical studies in enhancement of heat transfer and mass transport with electrohydrodynamics, two-phase systems, phase-change processes, heat and mass transfer in porous media, drying, and augmentation of heat and mass transfer with innovative impinging jets.

Research Faculty

Joseph C. Benedyk, Research Professor. B.S., M.S., Illinois Institute of Technology; Ph.D., Case Western Reserve University. Metals and materials processing research and development and product development.

Zhiyong Hu, Research Assistant Professor, B.S. Tianjin University, MS. PhD Institute of Metal Research, Chinese Academy of Sciences. Modeling the material processing (casting, extrusion, carburization, heat treatment), predicting the defects, temperature, stress and strain distribution in materials, optimizing the process parameters.

Vladimir Frankfurt, Research Professor.

Hansen Mansy, Research Associate Professor. B.S., M.S., Cairo University (Egypt); Ph.D., Illinois Institute of Technology. Biomedical acoustics, non-invasive measurement methods, biomedical fluid dynamics, flow-induced oscillations.

Cesar A. Sciammarella, Professor Emeritus. Dipl.Eng. C.E., Buenos Aires University (Argentina); Ph.D., Illinois Institute of Technology. Experimental mechanics of solids with particular emphasis on optics applied to mechanics of materials and stress analysis and fracture mechanics

Admission Requirements

Cumulative minimum undergraduate GPA: 3.0/4.0
GRE score minimum:
1000 (quantitative + verbal) 3.0 (analytical writing)
Typical admitted quantitative score is 650 minimum.
TOEFL minimum: 550/213/80*

Meeting the minimum GPA and test score requirements does not guarantee admission. Test scores and GPA are only two of several important factors considered. Admission as a regular graduate student normally requires a bachelor's degree from an accredited institution in mechanical engineering, aerospace engineering, metallurgical engineering, materials engineering or engineering mechanics. A candidate with a bachelor's degree in another field, and with proficiency in other engineering disciplines, mathematics and physics, may also be eligible for admission. However, students must remove any deficiencies in essential undergraduate courses that are prerequisites for the chosen degree program in addition to meeting the other requirements of the graduate program.

The associate chair for graduate programs serves as a temporary adviser to new full-time and part-time graduate students admitted to the department as matriculated students until an appropriate faculty member is selected as the adviser. Students are responsible for following the departmental procedures for graduate study. A guide to graduate study in the department is available on the departmental Web site (http://www.iit.edu/engineering/mmae) and in the MMAE main office (243 Engineering 1) to all registered MMAE graduate students, and should be consulted regularly for information on procedures, deadlines, forms and examinations. Departmental seminars and colloquia are conducted on a regular basis. All full-time graduate students must register for the MMAE 593 seminar course each semester and attend them regularly.

The department reserves the right to review and approve or deny the application for admission of any prospective degree-seeking student. Non-degree graduate students who intend to seek a graduate degree from the department must maintain a GPA of 3.0 and must apply for admission as a degree-seeking student prior to the completion of nine credit hours of study. Maintaining the minimum GPA requirement does not guarantee admission to MMAE graduate degree programs. A maximum of nine credit hours of approved coursework taken as a nondegree student and passed with a grade of "B" or better may be applied to the degree.

* Paper-based test score/computer-based test score/internet-based test score.

Master of Mechanical and Aerospace Engineering
Master of Materials Science and Engineering
Master of Manufacturing Engineering

30 credit hours

These programs are aimed at broadening student potential beyond the B.S., enhancing technical versatility and, in some instances, providing the opportunity for changes in career path. The Master of Engineering programs are course-only degree programs and require a minimum of 30 credit hours. There is no thesis or comprehensive examination requirement. The student, in consultation with his or her advisor, prepares a program of study that reflects individual needs and interests. The advisor, as well as the department's Graduate Studies Committee, the Department Chair, and the Graduate College must approve this program. Students working toward this degree are not eligible for departmental financial support.

Course Requirements for the Master of Mechanical and Aerospace Engineering

Required courses:

MMAE 501 Engineering Analysis I

AND one core course in major area of study
AND one of the following:

MMAE 451 Finite Element Methods I
MMAE 502 Engineering Analysis II
MMAE 517 Computational Fluid Dynamics
MMAE 532 Finite Element Methods II
MMAE 538 Computational Techniques in FEM
MMAE 544 Design Optimization
OR
MMAE 570 Computational Methods in Materials Processing

AND Elective courses as needed.

Core courses as determined by major area of study:
Fluid Dynamics:

MMAE 510 Fundamentals of Fluid Mechanics

Thermal Sciences:

MMAE 525 Fundamentals of Heat Transfer

Solids and Structures:

MMAE 530 Advanced Mechanics of Solids

Dynamics and Controls:

MMAE 541 Advanced Dynamics

Computer Aided Design and Manufacturing:

MMAE 545 Advanced CAD/CAM

Students may choose from a list of courses specific to their area of interest to complete degree requirements. Up to nine credit hours at the 400-level are allowed, assuming the courses were not required for an undergraduate degree. Up to six credit hours of accelerated (700-level) courses are allowed.

Course Requirements for the Master of Materials Science and Engineering

Required courses (for all students not specializing in ferrous metallurgy)

MMAE 563 Advanced Mechanical Metallurgy
MMAE 569 Advanced Physical Metallurgy
AND
MMAE 468 Introduction to Ceramic Materials
OR
MMAE 486 Properties of Ceramics

AND one course selected from the following:

MMAE 470 Introduction to Polymer Science
MMAE 579 Characterization of Polymers
OR
MMAE 580 Structure and Properties Polymers

Required courses (for students specializing in ferrous metallurgy)

MMAE 563 Advanced Mechanical Metallurgy
MMAE 569 Advanced Physical Metallurgy
MMAE 574 Ferrous Transformations
MMAE 575 Ferrous Products: Metallurgy and Manufacture
MMAE 578 Fiber Composite Materials

To complete the degree requirements, students may choose from a list of courses and may apply up to twelve credit hours of 400-level courses, as long as they were not used to satisfy requirements for an undergraduate degree. Up to six credit hours of accelerated (700-level) courses are allowed

Course Requirements for Master of Manufacturing Engineering

Mechanical and Aerospace Engineering Emphasis: Required Courses:

MMAE 545 Advanced CAD/CAM
MMAE 546 Advanced Manufacturing Engineering
MMAE 560 Statistical Process and Quality Control
AND
MMAE 547 Computer Integrated Manufacturing–Technologies
OR
MMAE 557 Computer Integrated Manufacturing–Systems

AND one course in materials science and engineering
AND one course emphasizing numerical methods:

MMAE 451 Finite Element Methods I
MMAE 517 Computational Fluid Dynamics
MMAE 532 Finite Element Methods II
MMAE 538 Computational Techniques in FEM
MMAE 544 Design Optimization
OR
MMAE 570 Computational Methods in Materials Processing

AND elective courses as needed.

Materials Science and Engineering Emphasis: Required Courses:

MMAE 547 Computer Integrated Manufacturing–Technologies
MMAE 560 Statistical Process and Quality Control

AND one of the following:

MMAE 445 CAD/CAM with Numerical Control
MMAE 545 Advanced CAD/CAM
MMAE 546 Advanced Manufacturing Engineering
OR
MMAE 576 Materials and Process Selection

AND one of the following:

MMAE 475 Powder Metallurgy
MMAE 574 Ferrous Transformations
MMAE 575 Ferrous Products: Metallurgy and – Manufacture
OR
MMAE 577 Lasers in Manufacturing

AND one course emphasizing numerical methods:

MMAE 451 Finite Element Methods I
MMAE 517 Computational Fluid Dynamics
MMAE 532 Finite Element Methods II
MMAE 538 Computational Techniques in FEM
MMAE 544 Design Optimization
OR
MMAE 570 Computational Methods in Materials Processing

AND elective courses as needed.

Master of Manufacturing Engineering via Internet

30 credit hours
The Master of Manufacturing Engineering via Internet is a course-only, professionally oriented degree program that requires a minimum of 30 credit hours. There is no thesis or comprehensive examination requirement. The student, in consultation with the academic advisor, prepares a program reflecting individual needs and interests. All courses are administered online.

Required core courses

MMAE 545 Advanced CAD/CAM
MMAE 546 Advanced Manufacturing Engineering
MMAE 560 Statistical Quality and Process Control
AND
MMAE 547 Computer Integrated Manufacturing-Technologies
OR
MMAE 557 Computer Integrated Manufacturing-Systems

AND one materials course:

MMAE 563 Advanced Mechanical Metallurgy

AND one course with emphasis on numerical methods:

MMAE 704 Introduction to Finite Element Analysis (2 credit hours)

AND at least 13 credit hours from:

MMAE 433 Design of Thermal Systems
MMAE 445 CAD/CAM with Numerical Control
MMAE 474 Metals Processing
MMAE 481 Introduction to Joining Processes
MMAE 540 Robotics
MMAE 557 Computer-Integrated Manufacturing-Systems
MMAE 589 Applications in Reliability Engineering I
MMAE 590 Applications in Reliability Engineering II
MMAE 715 Project Management (2 credit hours)
MMAE 720 Design Assurance (2 credit hours)

Master of Science in Mechanical and Aerospace Engineering
Master of Science in Materials Science and Engineering
Master of Science in Manufacturing Engineering

32 credit hours
Thesis
Oral comprehensive exam

The Master of Science degree program advances knowledge through post-baccalaureate coursework and state-of-the-art research in preparation for careers in industrial research and development. The M.S. degree is also generally acceptable as a prerequisite for study toward the doctorate. In line with the department's approach to its graduate programs, a student has considerable flexibility, in consultation with his or her program adviser, in formulating an M.S. program.

The M.S. in Mechanical and Aerospace Engineering or the M.S. in Materials Science and Engineering requires completion of a minimum of 32 credit hours of approved work, which includes six to eight credit hours of thesis research. Before completion of the first semester of graduate study, full-time students should select an area of specialization and a permanent adviser. Graduate students pursuing the M.S. degree on a part-time basis should select a permanent adviser before registering for their twelfth credit hour. The student, in consultation with the adviser, prepares a program of study that reflects individual needs and interests. The adviser must approve this program, as well as the department's Graduate Studies Committee, the Department Chair, and the Graduate College.

After completion of the thesis, the student is required to pass an oral comprehensive examination on his or her thesis and related topics. The examination committee consists of at least three appropriate faculty members who are nominated by the thesis adviser and appointed by the department's Graduate Studies Committee.

Course Requirements for the Master of Science in Mechanical and Aerospace Engineering

Required courses:

MMAE 501 Engineering Analysis I
MMAE 502 Engineering Analysis II

AND one core course in major area of study
AND 6 or more credit hours of non-core courses in major area
AND elective courses as needed.

Core courses as determined by major area of study:

Fluid Dynamics:

MMAE 510 Fundamentals of Fluid Mechanics

Thermal Sciences:

MMAE 525 Fundamentals of Heat Transfer

Solids and Structures:

MMAE 530 Advanced Mechanics of Solids

Dynamics and Controls:

MMAE 541 Advanced Dynamics

Computer Aided Design and Manufacturing:

MMAE 545 Advanced CAD/CAM

No more than nine credit hours of 400-level courses that were not required for the completion of an undergraduate degree will be accepted as satisfying part of the program. Students with interdisciplinary programs will be given special consideration. Up to six credit hours of accelerated (700-level) courses are allowed.

Course Requirements for the Master of Science in Materials Science and Engineering

Required core courses (12 credit hours)

MMAE 563 Advanced Mechanical Metallurgy
MMAE 569 Advanced Physical Metallurgy
AND
MMAE 468 Introduction to Ceramic Materials
OR
MMAE 486 Properties of Ceramics

AND one course selected from the following:

MMAE 470 Introduction to Polymer Science
MMAE 579 Characterization of Polymers
OR
MMAE 580 Structure and Properties of Polymers

AND 12-14 hours of non-core courses

Up to 12 credit hours of 400-level, non-core courses that were not required for the completion of an undergraduate degree and approved by the Graduate Studies Committee may count toward satisfying this requirement. Up to six credit hours of accelerated (700-level) courses are allowed.

Course Requirements for Master of Science in Manufacturing Engineering

Mechanical and Aerospace Engineering Emphasis: Required Courses:

MMAE 545 Advanced CAD/CAM
MMAE 546 Advanced Manufacturing Engineering
MMAE 547 Computer Integrated Manufacturing–Technologies
MMAE 560 Statistical Process and Quality Control

AND one course in materials science and engineering
AND one course emphasizing numerical methods:

MMAE 451 Finite Element Methods I
MMAE 517 Computational Fluid Dynamics
MMAE 532 Finite Element Methods II
MMAE 538 Computational Techniques in FEM
MMAE 544 Design Optimization
OR
MMAE 570 Computational Methods in Materials Processing

AND elective courses as needed.

Materials Science and Engineering Emphasis: Required Courses:

MMAE 547 Computer Integrated Manufacturing-Technologies
MMAE 560 Statistical Process and Quality Control

AND one of the following:

MMAE 445 CAD/CAM with Numerical Control
MMAE 545 Advanced CAD/CAM
MMAE 546 Advanced Manufacturing Engineering
OR
MMAE 576 Materials and Process Selection

AND one of the following:

MMAE 475 Powder Metallurgy
MMAE 574 Ferrous Transformations
MMAE 575 Ferrous Products: Metallurgy and Manufacture
OR
MMAE 577 Lasers in Manufacturing

AND one course emphasizing numerical methods:

MMAE 451 Finite Element Methods I
MMAE 517 Computational Fluid Dynamics
MMAE 532 Finite Element Methods II
MMAE 538 Computational Techniques in FEM
MMAE 544 Design Optimization
OR
MMAE 570 Computational Methods in Materials Processing

AND elective courses as needed.

Doctor of Philosophy in Mechanical and Aerospace Engineering
Doctor of Philosophy in Materials Science and Engineering

84 credit hours beyond the Bachelor of Science
Qualifying examination
16 credit hours (minimum) of courses beyond the M.S.
One full year (minimum) of thesis research
Comprehensive examination
Dissertation and oral defense

This program provides advanced, research-based education and knowledge through advanced coursework, state-of-the-art and original research, and publication of novel results in preparation for careers in academia and industrial research and development.

The department offers programs leading to the Ph.D. in Mechanical and Aerospace Engineering and the Ph.D. in Materials Science and Engineering. The doctoral degree is awarded in recognition of a high level of mastery in one of the several fields of the department including a significant original research contribution. A student working toward the Ph.D. degree has great flexibility in formulating an overall program to meet individual needs under the guidance of an advisor and the department.

Further, the student must be accepted by a thesis advisor and pass a qualifying examination given by the department in order to be admitted to candidacy for the Ph.D. degree. The examination evaluates the student's background in order to determine the student's potential for achieving a doctorate.

The student, in consultation with the advisor, prepares a program of study to meet individual needs and interests, which must then be approved by the advisor, the department's Graduate Studies Committee, the Department Chair, and the Graduate College. The program of study usually consists of at least one full year of advanced coursework beyond the master's degree, or equivalent, and a minimum of one full year of thesis research.

After the student essentially completes all coursework, he or she must pass the Ph.D. comprehensive examination. Conducted by the student's Thesis Advisory Committee, this examination must be completed at least one year prior to graduation.

Concentrated research to satisfy the requirements of a doctoral dissertation is ordinarily conducted after the comprehensive examination has been passed. The dissertation must be approved by the student's Thesis Advisory Committee. Thesis research should be equivalent to at least one full years work, corresponding to up to 36 thesis credit hours. This work is performed on campus; the department's Graduate Studies Committee and the Dean of the Graduate College must approve off-campus research. The doctoral dissertation is expected to contain a distinct and substantial original contribution to the student's field of study. After the research has been completed and a preliminary draft of the dissertation is approved, the candidate defends his or her thesis at a final oral examination, which is open to the public.

Course Requirements for Mechanical and Aerospace Engineering

Required Courses:

MMAE 501 Engineering Analysis I
MMAE 502 Engineering Analysis II

AND two courses from group EA (fluid dynamics, thermals sciences and solids and structures students must take MMAE 507 Continuum Mechanics)
AND one core course in major area of study
AND one core course in second area
AND 9 or more credit hours of non-core courses in major area
AND elective courses as needed.

Core courses as determined by major area of study:
Fluid Dynamics:

MMAE 510 Fundamentals of Fluid Mechanics

Thermal Sciences:

MMAE 525 Fundamentals of Heat Transfer

Solids and Structures:

MMAE 530 Advanced Mechanics of Solids

Dynamics and Controls:

MMAE 541 Advanced Dynamics

Computer Aided Design and Manufacturing:

MMAE 545 Advanced CAD/CAM

Group EA:

MMAE 503 Advanced Engineering Analysis
MMAE 507 Introduction to Continuum Mechanics
MMAE 508 Perturbation Methods
MATH 512 Partial Differential Equations
MATH 515 Ordinary Differential Equations and Dynamical Systems
MATH 522 Mathematical Modeling
MATH 535 Optimization I
MATH 544 Stochastic Dynamics
MATH 545 Stochastic Partial Differential Equations
MATH 553 Discrete Applied Mathematics I
ECE 511 Analysis of Random Signals
ECE 531 Linear Systems Theory
ECE 537 Optimal Feedback Control
ECE 567 Statistical Signal Processing

Course Requirements for Material Science and Engineering

MMAE 501 Engineering Analysis I
MMAE 563 Advanced Mechanical Metallurgy
MMAE 569 Advanced Physical Metallurgy
AND
MMAE 468 Introduction to Ceramic Materials
OR
MMAE 486 Properties of Ceramics

AND one course selected from the following:

MMAE 470 Introduction to Polymer Science
MMAE 579 Characterization of Polymers
MMAE 580 Structure and Properties of Polymers

AND elective courses as needed.

Certificate Programs

Computer Integrated Design and Manufacturing

Required courses (select four)

MMAE 445 CAD/CAM with Numerical Control
MMAE 540 Robotics
MMAE 545 Advanced CAD/CAM
MMAE 547 Computer Integrated Manufacturing-Technologies
MMAE 557 Computer Integrated Manufacturing-Systems

Product Quality and Reliability Assurance

Required courses

MMAE 560 Statistical Quality and Process Control
MMAE 589 Applications in Reliability Engineering I
MMAE 590 Applications in Reliability Engineering II
MMAE 720 Introduction to Design Assurance

Course Descriptions

Numbers in parentheses represent class hours, lab hours, and total credit hours, respectively.

MMAE 501
Engineering Analysis I
Vectors and matrices, systems of linear equations, linear transformations, eigenvalues and eigenvectors, systems of ordinary differential equations, decomposition of matrices, and functions of matrices. Eigenfunction expansions of differential equations, self-adjoint differential operators, Sturm-Liouville equations. Complex variables, analytic functions and Cauchy-Riemann equations, harmonic functions, conformal mapping, and boundary-value problems. Calculus of variations, Euler's equation, constrained functionals, Rayleigh-Ritz method, Hamilton's principle, optimization and control. Prerequisite: Undergraduate course in differential equations.
(3-0-3)

MMAE 502
Engineering Analysis II
Generalized functions and Green's functions. Complex integration: series expansions of complex functions, singularities, Cauchy's residue theorem, and evaluation of real definite integrals. Integral transforms: Fourier and Laplace transforms, applications to partial differential equations and integral equations. Prerequisite: MMAE 501.
(3-0-3)

MMAE 503
Advanced Engineering Analysis
Selected topics in advanced engineering analysis, such as ordinary differential equations in the complex domain, partial differential equations, integral equations, and/or nonlinear dynamics and bifurcation theory, chosen according to student and instructor interest. Prerequisite: MMAE 502.
(3-0-3)

MMAE 507
Introduction to Continuum Mechanics
A unified treatment of those topics that are common to solid and fluid continua. General discussion of Cartesian tensors. Deformation, strain, strain invariants, rotation, compatibility conditions. Motion, velocity, deformation. Momentum, moment of momentum, energy, stress. Principles of balance of local momenta, equations of motion. Principles of frame indifference. Constitutive relations for fluids, elastic and plastic solids. Concurrent Prerequisite: MMAE 501.
(4-0-4)

MMAE 508
Perturbation Methods
Asymptotic series, regular and singular perturbations, matched asymptotic expansions, and WKB theory. Methods of strained coordinates and multiple scales. Application of asymptotic methods in science and engineering. Prerequisite: MMAE 501.
(3-0-3)

MMAE 510
Fundamentals of Fluid Mechanics
Kinematics of fluid motion. Constitutive equations of isotropic viscous compressible fluids. Derivation of Navier-Stokes equations. Lessons from special exact solutions, self-similarity. Admissibility of idealizations and their applications; inviscid, adiabatic, irrotational, incompressible, boundary- layer, quasi one-dimensional, linearized and creeping flows. Vorticity theorems. Unsteady Bernoulli equation. Basic flow solutions. Basic features of turbulent flows. Concurrent Prerequisite: MMAE 501.
(4-0-4)

MMAE 511
Dynamics of Compressible Fluids
Low-speed compressible flow past bodies. Linearized, subsonic, and supersonic flow past slender bodies. Similarity laws. Transonic flow. Hypersonic flow, mathematical theory of characteristics. Applications including shock and nonlinear wave interaction in unsteady one-dimensional flow and two-dimensional, planar and axisymmetric supersonic flow. Prerequisite: MMAE 510.
(3-0-3)

MMAE 512
Dynamics of Viscous Fluids
Navier-Stokes equations and some simple exact solutions. Oseen-Stokes flows. Boundary-layer equations and their physical interpretations. Flows along walls and in channels. Jets and wakes. Separation and transition to turbulence. Boundary layers in unsteady flows. Thermal and compressible boundary layers. Mathematical techniques of similarity transformation, regular and singular perturbation, and finite differences. Prerequisite: MMAE 510.
(3-0-3)

MMAE 513
Turbulent Flows
Stationary random functions. Correlation tensors. Wave number space. Mechanics of turbulence. Energy spectrum. Dissipation and energy cascade. Turbulence measurements. Isotropic turbulence. Turbulent transport processes. Mixing and free turbulence. Wall-constrained turbulence. Compressibility effects. Sound and pseudo-sound generated by turbulence. Familiarity with basic concepts of probability and statistics and with Cartesian tensors is assumed. Prerequisite: MMAE 510.
(4-0-4)

MMAE 514
Stability of Viscous Flows
Concept of hydrodynamic stability. Governing equations. Analytical and numerical treatment of eigenvalue problems and variational methods. Inviscid stability of parallel flows and spiral flows. Thermal instability and its consequences. Stability of channel flows, layered fluid flows, jets and flows around cylinders. Other effects and their consequences; moving frames, compressibility, stratification, hydromagnetics. Nonlinear theory and energy methods. Transition to turbulence. Prerequisites: MMAE 502, MMAE 510.
(4-0-4)

MMAE 515
Engineering Acoustics
Characteristics of sound waves in two and three dimensions. External and internal sound wave propagation. Transmission and reflection of sound waves through media. Sources of sound from fixed and moving bodies. Flow-induced vibrations. Sound-level measurement techniques.
(3-0-3)

MMAE 516
Advanced Experimental Methods in Fluid Mechanics
Design and use of multiple sensor probes to measure multiple velocity components, reverse-flow velocities, Reynolds stress, vorticity components and intermittency. Simultaneous measurement of velocity and temperature. Theory and use of optical transducers, including laser velocimetry and particle tracking. Special measurement techniques applied to multiphase and reacting flows. Laboratory measurements in transitional and turbulent wakes, free-shear flows, jets, grid turbulence and boundary layers. Digital signal acquisition and processing. Prerequisite: Instructor consent.
(2-3-3)

MMAE 517
Computational Fluid Dynamics
Classification of partial differential equations. Finite-difference methods. Numerical solution techniques, including direct, iterative and multigrid methods, for general elliptic and parabolic differential equations. Numerical algorithms for solution of the Navier-Stokes equations in the primitive-variables and vorticity-streamfunction formulations. Grids and grid generation. Numerical modeling of turbulent flows. Prerequisites: Undergraduate course in numerical methods and MMAE 510.
(3-0-3)

MMAE 518
Spectral Methods in Computational Fluid Dynamics
Application of advanced numerical methods and techniques to the solution of important classes of problems in fluid mechanics. Emphasis is in methods derived from weighted-residuals approaches, like Galerkin and Galerkin-Tau methods, spectral and pseudo-spectral methods, and dynamical systems modeling via projections on arbitrary orthogonal function bases. Finite element and spectral element methods will be introduced briefly in the context of Galerkin methods. A subsection of the course will be devoted to numerical turbulence modeling, and to the problem of grid generation for complex geometries. Prerequisites: MMAE 501 and MMAE 510.
(3-0-3)

MMAE 520
Advanced Thermodynamics
Macroscopic thermodynamics: first and second laws applied to equilibrium in multicomponent systems with chemical reaction and phase change; availability analysis; evaluations of thermodynamic properties of solids, liquids, and gases for single and multicomponent systems. Applications to contemporary engineering systems. Prerequisite: Undergraduate course in applied thermodynamics.
(3-0-3)

MMAE 521
Statistical Thermodynamics
Nature of statistical thermodynamics, kinetic description of dilute gases. Elementary kinetic theory of transport processes. Classical statistics of independent particles. Development of quantum mechanics. Application of quantum mechanics. Quantum statistics and thermostatic properties of ideal gases. Prerequisite: Undergraduate course in applied thermodynamics or instructor's consent.
(3-0-3)

MMAE 523
Fundamentals of Power Generation
Thermodynamic, combustion, and heat transfer analyses relating to steam-turbine and gas-turbine power generation. Environmental impacts of combustion power cycles. Consideration of alternative and sustainable power generation processes such as wind and tidal, geothermal, hydroelectric, solar, fuel cells, nuclear power, and microbial.
(3-0-3)

MMAE 524
Fundamentals of Combustion
Combustion stoichiometry. Chemical equilibrium. Adiabatic flame temperature. Reaction kinetics. Transport processes. Gas flames classification. Premixed flames. Laminar and turbulent regimes. Flame propagation. Deflagrations and detonations. Diffusion flames. Spray combustion. The fractal geometry of flames. Ignition theory. Pollutant formation. Engine combustion. Solid phase combustion. Combustion diagnostics. Prerequisite: Undergraduate courses in applied thermodynamics and heat transfer or instructor's consent.
(3-0-3)

MMAE 525
Fundamentals of Heat Transfer
Modes and fundamental laws of heat transfer. The heat equations and their initial and boundary conditions. Conduction problems solved by separation of variables. Numerical methods in conduction. Forced and natural convection in channels and over exterior surfaces. Similarity and dimensionless parameters. Heat and mass analogy. Effects of turbulence. Boiling and condensation. Radiation processes and properties. Blackbody and gray surfaces radiation. Shape factors. Radiation shields. Prerequisite: Undergraduate course in heat transfer.
(3-0-3)

MMAE 526
Heat Transfer: Conduction
Fundamental laws of heat conduction. Heat equations and their initial and boundary conditions. Steady, unsteady and periodic states in one or multidimensional problems. Composite materials. Methods of Green's functions, eigenfunction expansions, finite differences, finite element methods. Prerequisites: MMAE 502 and MMAE 525.
(3-0-3)

MMAE 527
Heat Transfer: Convection and Radiation
Convective heat transfer analyses of external and internal flows. Forced and free convection. Dimensional analysis. Phase change. Heat and mass analogy. Reynolds analogy. Turbulence effects. Heat exchangers, regenerators. Basic laws of radiation heat transfer. Thermal radiation and quantum mechanics pyrometry. Infrared measuring techniques. Prerequisite: MMAE 525.
(3-0-3)

MMAE 528
Liquid-Vapor Phase-Change Phenomena
This course focuses on basic elements of condensation and vaporization processes. Specifically, this course covers the thermodynamic and mechanical aspects of interfacial phenomena and phase transitions, boiling and condensation near immersed bodies, and internal flow convective boiling and condensation. Prerequisite: MMAE 525 and MMAE 510 or instructor's consent.
(3-0-3)

MMAE 529
Theory of Plasticity
Phenomenological nature of metals, yield criteria for 3-D states of stress, geometric representation of the yield surface. Levy-Mises and Prandtl- Reuss equations, associated and nonassociated flow rules, Drucker's stability postulate and its consequences, consistency condition for nonhardening materials, strain hardening postulates. Elasticplastic boundary value problems. Computational techniques for treatment of small and finite plastic deformations. Prerequisite: MMAE 530. (3-0-3). Same as CAE 588.
(3-0-3)

MMAE 530
Advanced Mechanics of Solids
Mathematical foundations: tensor algebra, notation and properties, eigenvalues and eigenvectors. Kinematics: deformation gradient, finite and small strain tensors. Force and equilibrium: concepts of traction/stress, Cauchy relation, equilibrium equations, properties of stress tensor, principal stresses. Constitutive laws: generalized Hookes law, anisotropy and thermoelasticity. Boundary value problems in linear elasticity: plane stress, plane strain, axisymmetric problems, Airy stress function. Energy methods for elastic solids. Torsion. Elastic and inelastic stability of columns. Prerequisite: Undergraduate course in mechanics of solids. Concurrent Prerequisite: MMAE 501.
(3-0-3)

MMAE 531
Theory of Elasticity
Notions of stress and strain, field equations of linearized elasticity. Plane problems in rectangular and polar coordinates. Problems without a characteristic length. Plane problems in linear elastic fracture mechanics. Complex variable techniques, energy theorems, approximate numerical techniques. Prerequisite: MMAE 530.
(3-0-3)

MMAE 532
Finite Element Methods II
Continuation of MMAE 451/CAE 442. Covers the theory and practice of advanced finite element procedures. Topics include implicit and explicit time integration, stability of integration algorithms, unsteady heat conduction, treatment of plates and shells, small-strain plasticity, and treatment of geometric nonlinearity. Practical engineering problems in solid mechanics and heat transfer are solved using MATLAB and commercial finite element software. Special emphasis is placed on proper time step and convergence tolerance selection, mesh design, and results interpretation. Concurrent Prerequisite: MMAE 451 or CAE 442.
(3-0-3)

MMAE 533
Fatigue and Fracture Mechanics
Analysis of the general state of stress and strain in solids; dynamic fracture tests (FAD, CAT). Linear elastic fracture mechanics (LEFM), Griffith- Irwin analysis, ASTM KIC, KIPCI, KIA, KID. Plane stress, plane strain; yielding fracture mechanics (COD, JIC). Fatigue crack initiation. Goodman diagrams and fatigue crack propagation. Notch sensitivity and stress concentrations. Low-cycle fatigue, corrosion and thermal fatigue. Prerequisite: Undergraduate course in mechanics of solids.
(3-0-3)

MMAE 536
Experimental Solid Mechanics
Review of applied elasticity. Stress, strain and stress-strain relations. Basic equations and boundary value problems in plane elasticity. Methods of strain measurement and related instrumentation. Electrical resistance strain gauges, strain gauge circuits and recording instruments. Analysis of strain gauge data. Brittle coatings. Photoelasticity; photoelastic coatings; moire methods; interferometric methods. Applications of these methods in the laboratory. Prerequisite: Undergraduate course in mechanics of solids.
(3-2-4)

MMAE 538
Computational Techniques in Finite Element Methods
Survey of numerical methods as applied to FEM software. Database management, equation solvers, eigenvalue routines and schemes for direct integration (both implicit/ explicit), all as employed in the development of a finite element program. Topics also covered include band and front minimizer, static and dynamic substructuring via superelements, and sensitivity studies. Same as CAE 534. Prerequisite: MMAE 451 or CAE 442.
(3-0-3)

MMAE 540
Robotics
Kinematics and inverse kinematics of manipulators. Newton-Euler dynamic formulation. Independent joint control. Trajectory and path planning using potential fields and probabilistic roadmaps. Adaptive control. Force control. Prerequisite: MMAE 443 or equivalent. Concurrent prerequisite: MMAE 501.
(3-0-3)

MMAE 541
Advanced Dynamics
Kinematics of rigid bodies. Rotating reference frames and coordinate transformations; Inertia dyadic. Newton-Euler equations of motion. Gyroscopic motion. Conservative forces and potential functions. Generalized coordinates and generalized forces. Lagrange's equations. Holonomic and nonholonomic constraints. Lagrange multipliers. Kane's equations. Elements of orbital and spacecraft dynamics. Prerequisite: Undergraduate course in dynamics. Concurrent prerequisite: MMAE 501.
(3-0-3)

MMAE 543
Modern Control Systems
Review of classical control. Discrete-time systems. Linear difference equations. Z-transform. Design of digital controllers using transform methods. State-space representations of continuous and discrete-time systems. State-feedback. Controllability and observability. Pole placement. Optimal control. Linear-Quadratic Regulator (LQR). Probability and stochastic processes. Optimal estimation. Kalman Filter. Prerequisite: Undergraduate course in classical control. Concurrent prerequisite: MMAE 501
(3-0-3)

MMAE 544
Design Optimization
Optimization theory and practice with examples. Finite-dimensional unconstrained and constrained optimization, Kuhn-Tucker theory, linear and quadratic programming, penalty methods, direct methods, approximation techniques, duality. Formulation and computer solution of design optimization problems in structures, manufacturing and thermofluid systems. Prerequisite: Undergraduate course in numerical methods.
(3-0-3)

MMAE 545
Advanced CAD/CAM
Interactive computer graphics in mechanical engineering design and manufacturing. Mathematics of three-dimensional object and curved surface representations. Surface versus solid modeling methods. Numerical control of machine tools and factory automation. Applications using commercial CAD/CAM in design projects. Prerequisite: MMAE 445 or instructor's consent.
(3-0-3)

MMAE 546
Advanced Manufacturing Engineering
Introduction to advanced manufacturing processes, such as powder metallurgy, joining and assembly, grinding, water jet cutting, laser-based manufacturing, etc. Effects of variables on the quality of manufactured products. Process and parameter selection. Important physical mechanisms in manufacturing process. Prerequisite: Undergraduate course in manufacturing processes or instructor's consent.
(3-0-3)

MMAE 547
Computer-Integrated Manufacturing-Technologies
The use of computer systems in planning and controlling the manufacturing process including product design, production planning, production control, production processes, quality control, production equipment and plant facilities.
(3-0-3)

MMAE 548
Principles of Minimum-Weight Design
Minimum weight designs of basic structural elements are developed for different behavior criteria including stiffness, elastic and plastic strength, and stability. A number of optimization techniques are used to explore various structural concepts, such as prestressing, statistical screening and energized systems. Prerequisite: Undergraduate course in mechanics of solids. Concurrent prerequisite: MMAE 530.
(3-0-3)

MMAE 551
Experimental Mechatronics
Team based project. Microprocessor controlled electromechanical systems. Sensor and actuator integration. Basic analog and digital circuit design. Limited enrollment. Prerequisite: MMAE 443 or instructor's consent.
(2-3-3)

MMAE 555
Introduction to Navigation Systems
Fundamental concepts of positioning and dead reckoning. Principles of modern satellite-based navigation systems, including GPS, GLONASS, and Galileo. Differential GPS (DGPS) and augmentation systems. Carrier phase positioning and cycle ambiguity resolution algorithms. Autonomous integrity monitoring. Introduction to optimal estimation, Kalman filters, and covariance analysis. Inertial sensors and integrated navigation systems. Prerequisite: MMAE 443 or equivalent. Concurrent prerequisite: MMAE 501.
(3-0-3)

MMAE 556
Nanoscale Imaging and Manipulation
Includes an overview of scanning probe microscopy; and of AFM imaging: Mathematical morphology, imaging simulation and surface recognition, high-speed AFM imaging. Also covers nanoscale physics, including probing nanoscale forces, van der Waals force, electrostatic force, capillary force. Nanomanipulation topics such as mechanical scratching and pushing electropheresis, and augmented reality. Manipulation automation and manipulation planning. Applications of selected topics also covered.
(3-0-3)

MMAE 557
Computer-Integrated Manufacturing-Systems
Advanced topics in computer-integrated manufacturing, including control systems, group technology, cellular manufacturing, flexible manufacturing systems, automated inspection, lean production, just-in-time production, and agile manufacturing systems.
(3-0-3)

MMAE 560
Statistical Quality and Process Control
Basic theory, methods and techniques of on-line, feedback quality control systems for variable and attribute characteristics. Methods for improving the parameters of the production, diagnosis, and adjustment processes so that quality loss is minimized. Same as CHE 560.
(3-0-3)

MMAE 561
Solidification
Properties of liquids, undercooling, solidification of single- and poly-phase alloys, zone processes, controlled and directional solidification reactions. Prerequisite: Background in crystal structure and thermodynamics.
(3-0-3)

MMAE 562
Design of Modern Alloys
Phase rule, multicomponent equilibrium diagrams, determination of phase equilibria, parameters of alloy development, prediction of structure and properties. Prerequisite: Background in phase diagrams and thermodynamics.
(2-0-2)

MMAE 563
Advanced Mechanical Metallurgy
Analysis of the general state of stress and strain in solids. Analysis of elasticity, plasticity and fracture, with a major emphasis on the relationship between properties and structure. Isotropic and anisotropic yield criteria. Testing and forming techniques related to creep and superplasticity. Deformation mechanism maps. Fracture mechanics topics related to testing and prediction of service performance. Static loading to onset of rapid fracture, environmentally assisted cracking fatigue, and corrosion fatigue. Prerequisite: Background in mechanical properties.
(3-0-3)

MMAE 564
Dislocations and Strengthening Mechanics
Basic characteristics of dislocations in crystalline materials. Dislocations and slip phenomena. Application of dislocation theory to strengthening mechanisms. Strain hardening. Solid solution and particle strengthening. Dislocations and grain boundaries. Grain size strengthening. Creep. Fatigue. Prerequisite: Background in materials analysis.
(3-0-3)

MMAE 565
Materials Laboratory II
Advanced synthesis projects studying microstructure and properties of a series of binary and ternary alloys. Gain hands-on knowledge of materials processing and advanced materials characterization through an integrated series of experiments to develop understanding of the processing-microstructure-properties relationship. Students arc melt a series of alloys, examine the cast microstructures as a function of composition using optical and electron microscopy, DTA, EDS, and XRD. The alloys are treated in different thermal and mechanical processes. The microstructural and mechanical properties modification and changes during these processes are characterized. Groups of students will be assigned different alloy systems, and each group will present their results orally to the class and the final presentation to the whole materials science and engineering group.
(1-6-3)

MMAE 566
Problems in High Temperature Methods
Temperature-dependent mechanical properties. Creep mechanisms. Basic concepts in designing high-temperature materials. Metallurgy of basic alloy systems. Surface stability. High-temperature oxidation. Hot corrosion. Coatings and protection. Elements of process metallurgy. Prerequisite: Background in mechanical properties, crystal defects, and thermodynamics.
(3-0-3)

MMAE 567
Fracture Mechanisms
Basic mechanisms of fracture and embrittlement of metals. Crack initiation and propagation by cleavage, microvoid coalescence, and fatigue mechanisms. Hydrogen embrittlement, stress corrosion cracking and liquid metal embrittlement. Temper brittleness and related topics. Prerequisites: Background in crystal structure, defects, and mechanical properties.
(3-0-3)

MMAE 568
Diffusion
Theory, techniques and interpretation of diffusion studies in metals. Prerequisite: Background in crystal structures, defects , and thermodynamics.
(2-0-2)

MMAE 569
Advanced Physical Metallurgy
Thermodynamics and kinetics of phase transformations, theory of nucleation and growth, metastability, phase diagrams. Prerequisite: Background in phase diagrams and thermodynamics.
(3-0-3)

MMAE 570
Computational Methods in Materials Processing
Advanced theories and computational methods used in understanding and modeling of various materials processing that involve deformation, solidification, microstructural changes, etc. This course will discuss the fundamental theories and mathematical models that describe the relevant physical phenomena in the computational framework of the finite element method. It will consist of three parts: (1) Lectures on fundamental theories and models, (2) computational and numerical methods, and (3) computer laboratories. Prerequisites: Background in finite-element methods and materials processing.
(3-0-3)

MMAE 571
Microstructural Characterization of Materials
Advanced optical microscopy. Scanning and transmission electron microscopies. X-ray microanalysis. Surface characterization. Quantitative microscopy. Elements of applied statistics.
(2-3-3)

MMAE 573
Transmission Electron Microscopy
Design, construction and operation of transmission electron microscope, including image formation and principles of defect analysis in materials science applications. Theory and use of state-of-the-art microcharacterization techniques for morphological, crystallographic, and elemental analysis at high spatial resolutions at 10 nanometers in metallurgical and ceramic studies will also be covered.
(2-3-3)

MMAE 574
Ferrous Transformations
Allotropic modifications in iron and the solid solution effects of the important alloying elements on iron. Physical metallurgy of pearlite, bainite and martensite reactions. Physical and mechanical property changes during eutectoid decomposition and tempering. Prerequisite: Background in phase diagrams and thermodynamics.
(3-0-3)

MMAE 576
Materials and Process Selection
Context of selection; decision analysis; demand, materials and processing profiles; design criteria; selection schemes; value and performance oriented selection; case studies.
(3-0-3)

MMAE 577
Lasers in Manufacturing
Lasers and components of laser systems. Applications of lasers in manufacturing processes, including thermal treatment, drilling, cutting, turning, milling, welding and prototyping.
(3-0-3)

MMAE 578
Fiber Composite Materials
Structure and methods of preparation of fibers and fiber-reinforced composites. Micromechanics of fiber and particle reinforced composites. Prediction of elastic constants and strength. Stress analysis. Interfacial mechanics and properties.
(3-0-3)

MMAE 581
Theory of Mechanical Behavior of Polymers
Molecular theories for glass transitions and viscoelastic properties, strength of rubbery and glassy polymers. Deformation of crystalline polymers. Yield phenomena in glassy polymers. Photo-elastic properties of polymers. Prerequisite: Background in polymer synthesis and properties.
(3-0-3)

MMAE 582
Ferrous Technology
Production of ferrous materials in the steel mill, including treatment of the iron blast furnace and steel making in basic oxygen and electric-arc furnace. Processing of the materials in the plant and thermodynamic reaction considerations. Emerging processes will also be discussed.
(3-0-3)

MMAE 589
Applications in Reliability Engineering I
This first part of a two-course sequence focuses on the primary building blocks that enable an engineer to effectively communicate and contribute as a part of a reliability engineering effort. Students develop an understanding of the long term and intermediate goals of a reliability program and acquire the necessary knowledge and tools to meet these goals. The concepts of both probabilistic and deterministic design are presented, along with the necessary supporting understanding that enables engineers to make design trade-offs that achieve a positive impact on the design process. Strengthening their ability to contribute in a cross functional environment, students gain insight that helps them understand the reliability engineering implications associated with a given design objective, and the customer's expectations associated with the individual product or product platforms that integrate the design. These expectations are transformed into metrics against which the design can be measured. A group project focuses on selecting a system, developing a flexible reliability model, and applying assessment techniques that suggest options for improving the design of the system.
(3-0-3)

MMAE 590
Applications in Reliability Engineering II
This is the second part of a two-course sequence emphasizing the importance of positively impacting reliability during the design phase and the implications of not making reliability an integrated engineering function. Much of the subject matter is designed to allow the students to understand the risks associated with a design and provide the insight to reduce these risks to an acceptable level. The student gains an understanding of the methods available to measure reliability metrics and develops an appreciation for the impact manufacturing can have on product performance if careful attention is not paid to the influencing factors early in the development process. The discipline of software reliability is introduced, as well as the influence that maintainability has on performance reliability. The sequence culminates in an exhaustive review of the lesson plans in a way that empowers practicing or future engineers to implement their acquired knowledge in a variety of functional environments, organizations and industries. The group project for this class is a continuation of the previous course, with an emphasis on applying the tools and techniques introduced during this second of two courses.
(3-0-3)

MMAE 591
Research and Thesis for M.S. Degree

MMAE 593
MMAE Seminar
Reports on current research. Fulltime graduate students in the department are required to register and attend.
(1-0-0)

MMAE 594
Projects for Professional Masters Students
Design projects for the Master of Mechanical and Aerospace Engineering, Master of Materials Science and Engineering, and Master of Manufacturing Engineering degrees.
(Variable Credit)

MMAE 597
Special Topics
Advanced topics in the fields of mechanics, mechanical and aerospace, materials science, and manufacturing engineering in which there is special student and staff interest.
(Variable Credit)

MMAE 691
Research and Dissertation for Ph.D. Degree

MMAE 704
Introduction to Finite Element Analysis
This course provides a comprehensive overview of the theory and practice of the finite element method by combining lectures with selected laboratory experiences. Lectures cover the fundamentals of linear finite element analysis, with special emphasis on problems in solid mechanics and heat transfer. Topics include the direct stiffness method, the Galerkin method, isoparametric finite elements, numerical integration, development of finite element equations, equation solvers, bandwidth of linear algebraic equations and other computational issues. Lab sessions provide experience in solving practical engineering problems using commercial finite element software. Special emphasis is given to mesh design and results interpretation using commercially available pre-and post-processing software. Note: This course is offered as an intersession short course.
(2-0-2)

MMAE 705
Computer Aided Design with Pro/ENGINEER
This course provides an introduction to computer-aided design and an associated finite element analysis technique. A series of exercises and instruction in Pro/ENGINEER will be completed. The operation of Mecanica (the associated FEM package) will also be introduced. Previous experience with CAD and FEA will definitely speed learning, but is not essential. Note: This course is offered as an intersession course.
(2-0-2)

MMAE 709
Overview of Reliability Engineering
This course covers the role of reliability in robust product design. It dwells upon typical failure mode investigation and develops strategies to design them out of the product. Topics addressed include reliability concepts, systems reliability, modeling techniques, and system availability predications. Case studies are presented to illustrate the cost-benefits due to pro-active reliability input to systems design, manufacturing, and testing.
(2-0-2)

MMAE 710
Dynamic and Nonlinear Finite Element Analysis
Provides a comprehensive understanding of the theory and practice of advanced finite element procedures. The course combines lectures on dynamic and nonlinear finite element analysis with selected computer labs. The lectures cover implicit and explicit time integration techniques, stability of integration algorithms, treatment of material and geometric nonlinearity, and solution techniques for nonlinear finite element equations. The computer labs train students to solve practical engineering problems in solid mechanics and heat transfer using ABAQUS and Hypermesh. Special emphasis is placed on proper time step and convergence tolerance selection, mesh design, and results interpretation. A full set of course notes will be provided to class participants as well as a CD-ROM containing course notes, written exercises, computer labs, and all worked out examples. Note: This class is offered as an intersession course. Concurrent Prerequisite: MMAE 704
(2-0-2)

MMAE 713
Engineering Economic Analysis
Introduction to the concepts of Engineering Economic Analysis, also known as micro-economics. Topics include equivalence, the time value of money, selecting between alternatives, rate of return analysis, compound interest, inflation, depreciation, and estimating economic life of an asset.
(2-0-2)

MMAE 715
Project Management
This course covers the basic theory and practice of project management from a practical viewpoint. Topics include project management concepts, resources, duration vs. effort, project planning and initiation, progress tracking methods, CPM and PERT, reporting methods, replanning, team project concepts, and managing multiple projects. Microsoft Project software will be used extensively.
(2-0-2)

MMAE 720
Design Assurance
This course covers a range of analytical and procedural methods which support product and process development. Also referred to as Six Sigma, this approach ensures a more effective product by defining design requirements based on a comprehensive examination of the circumstances of the application. The methodology includes the use of such techniques as time line analysis, cause and effect analysis, failure mode analysis and Taguchi's robust design approach. Additionally, the importance of developmental testing is emphasized.
(2-0-2)

MMAE 723
Discrete Event Simulation
Introduction to purposes, tools and concepts of Discrete Event Simulation with particular emphasis on simulation of production systems for the manufacturing and services sectors. Focus will be on theory and application rather than specific software packages, although one program will be used as an example.
(2-0-2)

Institute of Psychology

Life Sciences Building
3105 S. Dearborn St.
Chicago, IL 60616
312.567.3500
psychology@iit.edu
www.iit.edu/colleges/psych

Dean:
M. Ellen Mitchell

Assistant Dean:
Scott B. Morris

Associate Dean of Psychology Research:
Patrick Corrigan

Division Head, Clinical Psychology:
Tamara Sher

Division Head, Industrial, Organizational and Business Psychology:
Roya Ayman

Division Head, Rehabilitation Psychology:
Frank Lane

The Institute of Psychology offers graduate programs in Clinical, Industrial/Organizational (I/O) and Rehabilitation Psychology. The institutes goal is to provide students with a scientist-practitioner model of training that integrates theory, research, and practice. Each program requires specific research, practicum, internship and curricular activities, which are linked to the specific goals of the individual training program.

Degrees Offered

Master of Science in Personnel and Human Resource Development
Master of Science in Psychology
Master of Science in Rehabilitation Counseling
Doctor of Philosophy in Psychology
Doctoral specialty training in: Clinical, Industrial/Organizational, Rehabilitation
Postdoctoral Retraining in Clinical Psychology

Combined Degree Programs

Bachelor of Science in Psychology/Master of Science in Personnel and Human Resources Development
Bachelor of Science in Psychology/Master of Science in Rehabilitation Counseling

Research Centers

Psychology faculty and students collaborate on applied research projects through the Center for Research and Service.

The National Consortium on Stigma and Empowerment (NCSE) is a reasearch group meant to promote recovery from mental illness by understanding the stigma associated with mental illness and promoting personal empowerment. The consortium itself is located at Illinois Institute of Technology, directed by Patrick Corrigan, and includes a collection of researches at Yale University, the University of Pennsylvania, Rutgers University, the University of Wisconsin, Illinois State University, and the University of Chicago.

Research Facilities

Facilities include laboratories for human behavioral assessment studies, psychophysiological research, infant and maternal attachment research, and testing and interviewing laboratories with one-way mirror viewing. Special computer and video equipment is part of the research facilities. There are graduate student offices, a testing library and a student lounge. The University Center for Disability Resources is housed within the Institute of Psychology. Many journals and databases are available through IITs libraries.

Research Areas

Clinical psychology faculty interests include health psychology, behavioral medicine, attachment, child social and emotional development, educational assessment, couples treatment, family therapy, social support, and mood disorders. Some clinical students work with Rehabilitation faculty in areas such as adjustment to disability, stages of change, stigma and prevention, psychiatric rehabilitation, and cross-cultural issues.

Industrial/Organizational faculty interests include leadership, diversity, organizational climate, work-family interface, safety in the workplace, trainng design and evaluation, performance appraisal, test development, selection bias, and item response theory. Rehabilitation faculty pursue research in the areas of adjustment to disability, vocational rehabilitation, factors affecting job placement, rehabilitation engineering technology, and psychiatric rehabilitation.

Faculty

Roya Ayman, Professor and Head of the Industrial, Organizational, and Business Psychology Division. B.A., M.A., Ph.D., University of Utah. Leadership, diversity, organizational climate, and work-family interface.

Patricia Bach, Assistant Professor and Practicum Coordinator, Clinical Division. B.A., B.S., University of Michigan; Ph.D., University of Nevada. Psychosocial treatment for psychosis; the role of verbal behavior in psychopathology; acceptance and commitment therapy.

Konstantin Cigularov, Assistant Professor, Industrial, Organizational, and Business Psychology Division. B.S., University of Economics, Varna, Bulgaria; M.S., East Central University; Ph.D., Colorado State University. Employee training programs, occupational safety and health.

Patrick Corrigan, Distinguished Professor, Rehabilitation Division. B.S., Creighton University; M. A., Roosevelt University; Psy.D., Illinois School of Professional Psychology. The stigma of disabilities, the disabilities and rehabilitation of people with serious mental illness.

J. Kemp Ellington, Assistant Professor, Industrial, Organizational, and Business Psychology Division. Ph.D., North Carolina State University. Training evaluation and effectiveness, performance appraisal issues such as rater effects, contextual influences, and developmental feedback.

Glen Geist, Professor Emeritus. B.A., Allegheny College; M.S., Ph.D., State University of New York, Buffalo. Factors affecting job placement, rehabilitation counselor education.

Ruthanna Gordon, Assistant Professor. B.A., Hampshire College; M.A., Ph.D., State University of New York, Stony Brook. Decision making, judgment, and memory (specializing in source/reality monitoring).

Joyce Hopkins, Associate Professor, Clinical Division. B.A., McGill University; M.A., Tufts University; Ph.D., University of Pittsburgh. Infant/maternal attachment, high-risk infants and toddlers, maternal psychopathology, and infant development.

Margaret Huyck, Professor Emerita. A.B., Vassar College; M.A., Ph.D., University of Chicago. Gerontology, adult development.

Chow Lam, Distinguished Professor, Rehabilitation Division. B.S., M.S.ed., University of Wisconsin, Whitewater; Ph.D., University of Wisconsin, Madison. Stages of change, cross-cultural issues in rehabilitation.

Frank Lane, Assistant Professor and Head of the Rehabilitation Psychology Division. B.A., St. Leo College; M.H.S., Ph.D. University of Florida. Rehabilitation technology, applied ethics, attitudes, crime, and disability

Jonathon Larson, Assistant Professor, Rehabilitation Division. B.A., Western Illinois University; M.S., Southern Illinois University; Ed.D., Roosevelt University. Staff burnout, psychiatric rehabilitation, supported employment, stigma, mental health leadership.

Eun-Jeong Lee, Assistant Professor Rehabilitation Division. B.A., M.A., The Catholic University of Korea; Ph.D., University of Wisconsin Madison. Cognitive Vulnerability Model of Depression for people with disabilities, psychosocial aspects to people with disabilities, positive psychology and disability, research methodologies, and epilepsy rehabilitation.

Alan Mead, Assistant Professor, Industrial, Organizational, and Business Psychology Division. B.A., M.S., Ph.D., University of Illinois-Urbana. Technological and methodological research areas, including applications of psychometric theory, data mining, computerized testing, analysis software; also individual differences theories of personality and culture.

M. Ellen Mitchell, Professor, Dean of the Institute, Clinical Division. B.A., Hamilton/Kirkland College; Ph.D., University of Tennessee. Social support, family and marital therapy.

Scott Morris, Associate Professor, Assistant Dean of the Institute, Industrial, Organizational, and Business Psychology Division. B.A., University of Northern Iowa; M.S., Ph.D., University of Akron. Personnel selection, employment discrimination, statistics.

Robert Schleser, Professor, Clinical Division. B.A., Rutgers University; M.S., Ph.D., Memphis State University. Sport and performance psychology, developmental issues, educational evaluation.

Tamara Goldman Sher, Professor and Head of the Clinical Psychology Division. B.A., University of Michigan; M.A., Ph.D., University of North Carolina. Health psychology, couples therapy, and couples and health.

Allen Wolach, Professor Emeritus. B.A., University of Illinois; M.A. Roosevelt University; Ph.D., University of New Mexico. Statistical packages, learning models.

Michael Young, Professor, Clinical Division. A.B., University of Chicago; M.A., Ph.D., Adelphi. Seasonal affective disorder, cognitive models of depression, statistical modeling of psychopathology.

Admission Requirements

Cumulative undergraduate GPA minimum: 3.0/4.0
GRE score minimum for M.S./Ph.D.:
1000 (quantitative + verbal) 3.0 (analytical writing)
Minimum TOEFL score: 550/213/80*

The faculty of the Institute of Psychology place primary emphasis on the GRE scores in the verbal and quantitative sections. The masters program in Rehabilitation Counseling does not require the GRE. Meeting the minimum GPA and test score requirements does not guarantee admission. Test scores and GPA are just two of several important factors considered. At least 18 credit hours of undergraduate study in psychology, with at least one course each in experimental psychology and statistics, are required.

Applicants for master's degree programs should have a bachelor's degree from an accredited institution and meet the minimum standards listed above. The exception is the master's in Rehabilitation Counseling; undergraduate general psychology courses are the only required prerequisites for that program. Prerequisite to admission to doctoral programs are a bachelor's or masters degree from an accredited institution, superior academic records in both undergraduate and graduate programs, and favorable recommendations. GRE results are required for all psychology doctoral programs. Applications for admission are evaluated by separate committees for each program (Clinical, Industrial/Organizational, Rehabilitation). Therefore, a prospective student must designate a specialty area on the appropriate form.

* Paper-based test score/computer-based test score/internet based test score.

Program Descriptions

The Clinical Psychology Division offers a Ph.D. degree in Clinical Psychology. The Clinical Psychology Ph.D. program has been fully accredited for over 25 years by the American Psychological Association, and offers training from the cognitive-behavioral and social learning theoretical frameworks. Based on the Boulder scientist-practitioner model, the program emphasizes an integration of clinical practice and applied clinical research. Working with a faculty mentor, students begin research work their first year. Students in the rehabilitation specialization track take rehabilitation courses as electives and do research with Rehabilitation faculty. Clinical practicum experiences take place at general and specialized clinical sites throughout the Chicago area. All students complete an APA-accredited internship. The program prepares students to be license-eligible in the state of Illinois. Graduates typically function as practitioners and researchers in medical centers and multi-disciplinary clinical settings.

The Industrial, Organizational, and Business Psychology Division offers an M.S. degree in Personnel and Human Resource Development and a Ph.D. in Industrial/Organizational Psychology. The Division emphasizes students' exposure to the scientist' and practitioners' viewpoints of the field. Students undertake a balanced education in personnel and organizational topics, disciplines and research. The program strengthens students' quantitative skills for research and consulting. All students are expected to complete two internships. These positions are within various organizations where students are responsible for human resource management and development functions. Students in the Personnel and Human Resource Development master's degree program receive the knowledge and skills necessary for professions in human resources, as well as management consulting positions. Ph.D. students will acquire a strong theoretical and methodological background in various areas of I/O psychology and are required to complete a minimum of two research projects. Many students in the past have presented and published their work. The Ph.D. curriculum prepares students to choose from several career paths in consulting, corporate human resources, or research and teaching.

The Rehabilitation Psychology Division offers an M.S. degre in Rehabilitation Counseling, a Ph.D. in Rehabilitation Counselor Education, and a Ph.D. in combined Clinical/Rehabilitation Psychology. The mission of the Rehabilitation Counseling program is to prepare master's degree students to perform a vital role as counselors in the vocational, educational, and personal adjustment of persons with physical, mental, and emotional disabilities. The objectives of the program are to: (1) Train individuals in knowledge most relevant to the practice of rehabilitation counseling and (2) Develop mature, capable professionals who are able to relate constructively to clients, to understand normal and deviant behavior, demonstrate therapeutic interactive skills, and to facilitate the clients development of problem solving skills. The program also provides advanced training for persons presently employed in agencies and facilities offering services to persons with disabilities. It prepares counselors for employment in state, federal, and private rehabilitation agencies; hospitals; correctional institutions; public schools; rehabilitation centers; and other organizations serving persons with physical, psychiatric, mental, social or emotional disabilities. The Ph.D. program prepares individuals for careers in university teaching, research and clinical practice in Rehabilitation Psychology. A minor is required for the rehabilitation counseling education track.

Master of Science in Personnel and Human Resources Development

43 credit hours

The M.S. in Personnel and Human Resources Development is designed for individuals who wish to work as applied professionals in areas such as management consulting, human resource management, industrial relations and consumer behavior.

Core course requirements

PSYC 511 Psychometric Theory
PSYC 529 Personnel Selection and Evaluation
PSYC 545 Graduate Statistics I
PSYC 546 Graduate Statistics II
PSYC 555 Training
PSYC 556 Organizational Psychology
PSYC 558 Internship
PSYC 559 Internship

These core courses provide a broad understanding of human relations in the workplace through theory and practice. Electives in industrial/organizational psychology, vocational rehabilitation, public administration, law and business allow for specialization. Designed as a two-year full-time program with a minimum of 43 credit hours required, it also can be undertaken on a part-time basis. A research thesis or project is not required. Completing each I/O and statistics course with a minimum of a "B" constitutes the comprehensive requirement. There is no foreign language requirement.

Minimum requirements for admission include a bachelors degree from an accredited institution, a minimum undergraduate GPA of 3.1/4.0, GRE results, and favorable recommendations. Further information can be obtained from the institute upon request.

Master of Science in Psychology

32 credit hours minimum
Thesis and oral defense

The M.S. in Psychology is almost exclusively a preliminary degree for students working toward a Ph.D. The aim is to evaluate and prepare students for work beyond the M.S. All candidates for the M.S. in Psychology must complete the following requirements:

PSYC 545 Graduate Statistics I
PSYC 546 Graduate Statistics II
PSYC 591 Research and Thesis for the M.S. Degree

All students pursuing the M.S. in Psychology degree must complete the following four core courses within two years after the sequence is started:

PSYC 501 Physiological Foundations of Behavior
PSYC 502 Social Bases of Behavior
PSYC 503 Learning, Cognition, and Motivation
PSYC 504 Individual and Cultural Differences

This sequence constitutes the comprehensive requirement for the degree. Students must complete it with a minimum of a "B average and no more than one "C in these four core courses. There is no foreign language requirement. The remaining courses are planned by the student and adviser according to the requirements of the program area in which the student wishes to specialize. No more than 12 credit hours may be taken below the 500 level. More detailed information concerning requirements for specialization in the areas of clinical or industrial/ organizational psychology is available from the institute upon request.

Each student must prepare a thesis proposal before beginning M.S. thesis research. The thesis proposal is prepared in collaboration with a faculty research advisor. Upon completion of the thesis, the student must satisfactorily complete an oral examination, which is limited to a defense of the thesis. For students in the Clinical Psychology program, the oral examination committee must include the advisor and one additional Clinical Psychology faculty member. For students in the Industrial and Organizational Psychology program, the oral examination committee must include the advisor and two additional psychology faculty members; the advisor, and at least one additional committee member must be from the I/O program.

Master of Science in Rehabilitation Counseling

60 credit hours
Project

The Rehabilitation Counseling education program, fully accredited by the Council on Rehabilitation Education since 1975, is designed to educate the student to function as a rehabilitation counselor for persons with physical or mental disabilities who need psychosocial and vocational readjustment. The goal of rehabilitation is to help such persons realize their optimum level of vocational adjustment and independent living through the provision or coordination of evaluation, physical restoration, counseling, training, placement and follow-up services. The demand for rehabilitation counselors has exceeded the supply in recent years, in public, private, nonprofit and for-profit sectors.

A core of required graduate courses provides the basic knowledge and skills necessary to the field of rehabilitation. These include rehabilitation principles and practices, individual and group counseling, job placement, medical and psychosocial aspects of disability, vocational evaluation and research methods.

Concurrently, field work of progressively increasing complexity takes place at a variety of rehabilitation facilities in the Chicago area. These include the state department of vocational rehabilitation, community rehabilitation facilities, rehabilitation centers, mental health centers, medical hospitals, and other facilities for persons with mental and physical disabilities. Within the program, two specialization tracks are available for interested students. The psychiatric rehabilitation track prepares students to work with persons with mental illness. The assistive technology track prepares students to use assistive technology and devices to help persons with disabilities in independent living and work accommodations.

The two-year 60-credit-hour program allows time for electives. A student entering with appropriate undergraduate courses and at least one year of work experience as a rehabilitation counselor may complete the degree in a minimum of 48 credit hours. Graduation requires successful completion of a research project. The comprehensive requirement is satisfied when the student completes the following courses with a B average:

PSYC 410 Vocational Rehabilitation
PSYC 411 Medical Aspects of Disabling Conditions
PSYC 412 Multicultural and Psychosocial Aspects of Disability
PSYC 513 Assessment in Rehabilitation Counseling
PSYC 523 Theories of Psychotherapy
PSYC 549 Practicum in Rehabilitation Counseling
PSYC 557 Pre-Practicum in Rehabilitation Counseling
PSYC 561 Group Counseling
PSYC 562 Job Placement
PSYC 563 Human Growth and Career Development
PSYC 564 Rehabilitation Research Seminar

Other requirements include a rehabilitation internship (PSYC 578 or PSYC 579) and a research project (PSYC 594).

For professionals employed in community rehabilitation facilities and state agencies, and who want to pursue a M.S. in Rehabilitation Counseling degree or need it to maintain employment, there is a 48 credit hour part-time program designed to meet the needs of the working professional. The part-time program takes three years to complete and courses are offered in the evening and via distance education. The required fieldwork experiences (practicum and internship) are typically worked out with the student's place of employment. Applications for the program are received continuously with new students enrolled in a cohort beginning every three years.

Full and part-time students admitted to the program are eligible for Rehabilitation Services Administration (RSA) traineeships that cover the cost of tuition and a stipend for books and supplies. Traineeships are awarded on the basis of economic need and academic performance. The precise numbers of traineeships vary from year to year and cannot be guaranteed to any student at the time of acceptance in the program.

Doctor of Philosophy

96 credit hours minimum
Comprehensive exam
Dissertation and oral defense
Internship (for Clinical and Industrial/Organizational specializations)

A minimum of 96 credit hours beyond the bachelors degree is required for the Ph.D. Individual specialties (e.g. Clinical) may require completion of additional courses. There is no foreign language requirement. Details concerning specific program requirements are available from the institute upon request.

All candidates for the Ph.D. in Psychology must complete the following requirements:

PSYC 545 Graduate Statistics I
PSYC 546 Graduate Statistics II
PSYC 691 Research and Thesis for the Ph.D. degree

At least two of the following are required: (Students must check with their academic advisor to ascertain which of the following courses best pertains to their specific program emphasis)

PSYC 540 Research Methods
PSYC 551 Design and Implementation of Experiments
PSYC 554 Survey of Multivariate Statistics
PSYC 511 Psychometric Theory

All students pursuing the Ph.D. in psychology must complete the following four core courses within two years after the sequence is started:

PSYC 501 Physiological Foundations of Behavior
PSYC 502 Social Bases of Behavior
PSYC 503 Learning, Cognition and Motivation
PSYC 504 Individual and Cultural Differences

Students must complete the sequence with a minimum of a "B" average and no more than one "C" in these four courses. In addition, History and Systems of Psychology, or completion of an equivalent course that must be shown on the students transcript, is required for all students pursuing the Ph.D. in Psychology (for students in the Clinical Psychology Program. this must be a graduate-level course).

Written Ph.D. comprehensive examinations are held once each semester for the I/O program. Clinical students must schedule their oral comprehensive exam in consultation with their faculty advisor. These must be passed before students can register for dissertation credit hours.

All students are expected to show competency in methodology and research design, as well as in the specific content of their program areas. Before beginning thesis research, a student must present a thesis proposal for approval by a committee of the faculty. The final requirement of the Ph.D. program is an oral examination restricted to defense of the thesis and conducted by a committee nominated by the Institute and appointed by the dean of graduate studies.

The Ph.D. program with specialization in Clinical Psychology is accredited by the American Psychological Association. Completion typically requires five years of study beyond the bachelor's degree, and a one-year full-time internship. Students with prior graduate work may receive advanced credit. The program follows the scientist- practitioner model and emphasizes an integration of clinical practice and applied clinical research. Working with a faculty mentor, students begin research work their first year. Students complete 2-3 years of 15-20 hour/week practicum training that includes a wide variety of assessment and treatment experiences with a broad range of clients, including minority and underserved populations. Training sites include medical centers, community mental health centers and clinics throughout the Chicago metropolitan area. Clinical supervision is provided both onsite and at IIT. All students complete an APA-accredited internship. The program prepares students to be license-eligible in the state of Illinois. Graduates typically function as practitioners and researchers in medical centers and multi-disciplinary clinical settings.

Students may elect to further specialize within the rehabilitation track. It consists of practica in a rehabilitation or behavioral medicine setting. In addition, students complete 15 hours of rehabilitation coursework and a masters project and dissertation related to rehabilitation or behavioral medicine. The development of a specialization within the rehabilitation track occurs in addition to the standard program of study in Clinical Psychology.

A Clinical Respecialization Certificate Program also is offered for individuals with a Ph.D. in another area of psychology. The postdoctoral respecialization program provides the same core clinical training as the doctoral program. Completion typically takes three years, including one-year full-time internship. In recognition of the diverse previous experiences of participants, the program is tailored to the individual's specific training needs.

Doctor of Philosophy (continued)

The Ph.D. program with specialization in Industrial and Organizational psychology includes coursework in both personnel and organizational psychology. Two semesters of internship in an organizational setting are usually required. Students in this program frequently are advised to supplement departmental offerings with selected courses in management, sociology, and law.

The Ph.D. program with specialization in Rehabilitation Counselor Education includes advanced seminars in adult career development and vocational behavior, professional and ethical issues, and psychosocial bases of disability and behavior, as well as practice in research, teaching and supervision. Students can supplement their studies with electives focusing on psychiatric rehabilitation, rehabilitation administration and organizational psychology or clinical psychology.

The Industrial/Organizational and Rehabilitation programs usually require three years of study beyond the masters degree. Further information on all programs is available from the Institute.

Special Fellowships

Since its inception, the Rehabilitation Services Administration (RSA) of the U.S. Department of Education has continuously funded IITs Rehabilitation Counselor Education programs. The RSA traineeships are designed to increase the number of practicing rehabilitation counselors by covering the cost of tuition and books. Traineeship grants, when available, may cover up to full tuition plus a monthly stipend. To a limited number of students, the Institute also awards teaching and research assistantships, which cover partial tuition as well as provide a stipend. The amount of the stipend and tuition scholarships depends upon the terms of the appointment. The Institute requires that students on assistantships apply for federal work study support.

Bachelor of Science in Psychology/Master of Science in Personnel and Human Resources Development

For IIT undergraduate psychology majors it is possible to earn a master's degree in Personnel and Human Resources Development in 1.5 years instead of the normal 2 years. The regular master's program in Personnel and Human Resources Development requires 43 credit hours post bachelors usually completed over the course of 2 years (see program description in this bulletin). However, IIT psychology majors who meet the criteria for regular admission to the Master's program can consider completing their Master's degree more quickly by smart use of their electives. In the senior year, qualified students can take graduate courses to meet their undergraduate elective requirements. For a class to be accepted towards the PHRD master's the student needs to obtain a grade of B or better. By taking psychology courses that also apply to the Personnel and Human Resources Development Program, students can reduce the graduate degree requirements by 13 credit hours. Interested students should submit a formal application to the PHRD program in the fall of their sophomore or junior year and work closely with the Head of the Industrial, Organizational, and Business Psychology Division and their undergraduate academic advisor throughout to ensure proper course sequencing.

The following courses are required for the M.S. degree in Personnel and Human Resources Development. They can be taken as part of required or elective courses for the B.S. degree in Psychology. If taken as an undergraduate, these courses do not have to be repeated for the graduate program. Students should also work closely with their undergraduate academic advisor to best plan a program leading to the combined degrees in the shortest possible time.

In the senior year, and in consultation with the Director of I/O Program, students may take the following courses:

PSYC 502 Social Bases of Behavior
PSYC 529 Personnel Selection*
PSYC 545 Graduate Statistics I*
PSYC 546 Graduate Statistics II*
PSYC 556 Organizational Psychology*
MBA 510 Financial and Managerial Accounting
MBA 560 Marketing

Courses noted * above need to be taken in the senior year in order to accelerate completion of the Masters degree.

In the summer after completion of the B.S., students will be eligible to complete their first required graduate internship. This needs to be coordinated during the senior year and prior to summer with Director of the I/O Program.

Bachelor of Science in Psychology/Master of Science in Rehabilitation Counseling

For IIT undergraduate psychology majors it is possible to earn a master's degree in Rehabilitation Counseling in 1.5 years instead of the normal 2 years. The regular masters program in Rehabilitation Counseling requires 60 credit hours post bachelor's usually completed over the course of 2 years (see program description in this bulletin). However, IIT psychology majors who meet the criteria for regular admission to the Master's program can consider completing their Master's degree more quickly by smart use of their electives. In the senior year, qualified students can take graduate courses to meet their undergraduate elective requirements. For a class to be accepted towards the Rehabilitation Counseling masters the student needs to obtain a grade of B or better. By taking psychology courses that also apply to the Rehabilitation Counseling program, students can reduce the graduate degree requirements by 15 credit hours, or one full-time semester. Interested students should submit a formal application to the Rehabilitation Counseling Program in the fall of their sophomore or junior year and work closely with the Head of the Rehabilitation Division and their undergraduate academic advisor throughout to ensure proper course sequencing.

The following courses are required for the M.S. degree in Rehabilitation Counseling. They can be taken as part of required or elective courses for the B.S. degree in Psychology. If taken as an undergraduate, these courses do not have to be repeated for the graduate program. Students should also work closely with their undergraduate academic advisor to best plan a program leading to the combined degrees in the shortest possible time.

In the senior year, and in consultation with the Head of Rehabilitation Division, students may take the following courses:

PSYC 410 Vocational Rehabilitation
PSYC 411 Medical Aspects of Disabling Conditions
PSYC 412 Multicultural and Psychosocial Aspects of Disability
PSYC 513 Assessment in Rehabilitation Counsseling
PSYC 523 Introduction to Theories of Psychotherapy
PSYC 557 Pre-Practicum in Rehabilitation Counseling
PSYC 562 Job Placement
PSYC 563 Human Growth and Career Development
PSYC 583 Rehabilitation Engineering Technology I
PSYC 590 Psychiatric Rehabilitation

Certificate Programs

Compensation Management

Required Courses

ACC 510 Introductory Accounting (Stuart School of Business)
PSYC 710 Compensation and Benefits Application
PSYC 716 Base Pay Management
PSYC 717 Variable Pay Programs
PSYC 719 Fundamentals of Employee Benefits Programs

AND one of the following

PSYC 556 Organizational Psychology
PSYC 529 Personnel Selection and Evaluation

Psychiatric Rehabilitation

Required courses

PSYC 548 Vocational Psychiatric Rehabilitation
PSYC 588 Psychiatric Rehabilitation II: Evidence-Based Practices in Mental Health
PSYC 590 Psychiatric Rehabilitation

Rehabilitation Engineering Technology

Required courses

PSYC 583 Rehabilitation Engineering Technology I
PSYC 584 Rehabilitation Engineering Technology II
PSYC 585 Rehabilitation Engineering Technology III

Course Descriptions

Numbers in parentheses indicate class, lab and credit hours, respectively.

PSYC 501
Physiological Foundation of Behavior
A critical review of the anatomical and neurophysiological bases of behavior as related to theory and practice in psychology.
(3-0-3)

PSYC 502
Social Bases of Behavior
Critical overview of theory and research in social cognition, interpersonal relations, group dynamics and organizational psychology. Implications of principles for issues and problems in real-world social systems are developed.
(3-0-3)

PSYC 503
Learning, Cognition, and Motivation
Empirical and theoretical issues relating to learning, cognitive psychology, perceptual learning, drive and emotion will be surveyed. Emphasis will be placed on differing theoretical interpretations of a given set of data.
(3-0-3)

PSYC 504
Individual and Cultural Differences
Review of the basic models used to explore and explain how and why people differ from each other. The course will explore the influence of culture and individual characteristics such as gender, ability and personality, as well as how these influences change over a persons lifetime.
(3-0-3)

PSYC 506
Therapy I
First semester seminar and supervised training in basic clinical skills, including interviewing, development of therapeutic relationship, selection of appropriate goals, and assessment of therapy progress and outcome. Prerequisite: Active standing in the clinical program; must have approved clinical placement.
(3-0-3)

PSYC 507
Therapy II
Second semester seminar and supervised training in basic clinical skills, including interviewing, development of a therapeutic relationship, managing the process of therapy and assessing therapy progress. Prerequisites: PSYC 506; active standing in the clinical program; must have approved clinical placement.
(3-0-3)

PSYC 508
Ethics and Professional Issues I
This is an introductory course designed around ethical issues confronting clinical psychologists. It is offered to incoming first year students in an effort to allow them to think about ethical issues in treatment, assessment, and professional behavior. Using the APA ethics code as a guide, students present and respond to ethical dilemmas that they may face as they embark upon their career as clinical psychologists. Other professional issues are also discussed including the transition to graduate school, course selection decisions, and any other general graduate school questions that may arise.
(2-0-2)

PSYC 509
Ethics and Professional Issues II
This is a continuation of PSYC508, but offered to second semester, third year students. It is designed to prepare students for the later parts of the graduate student experience. Topics include dissertation research, the internship experience, and early job and career decisions. Barriers to successful completion of the program are discussed and problem solved. Ethical issues such as those confronting new Ph.D.s are also introduced.
(1-0-1)

PSYC 510
Clinical Assessment I
Seminar and supervised training in intellectual and cognitive assessment for adults and children. Research, psychometric characteristics, conceptual foundations, clinical applicability, administration, scoring and interpretation of major assessment instruments. Prerequisite: Active standing in the clinical program.
(3-0-3)

PSYC 511
Psychometric Theory
Basic understanding of principles and theories of psychological measurement emphasizing (1) theories and methods for estimation of reliability and validity, (2) techniques for the measurement of psychological variables, and (3) methods for construction of psychological and educational measuring instruments. Prerequisites: PSYC 545, PSYC 546.
(3-0-3)

PSYC 512
Clinical Assessment II
Seminar and supervised training in objective and projective assessment of adults and children. Research, psychometric characteristics, conceptual foundations, clinical applicability, administration, scoring and interpretation of major assessment instruments. Prerequisite: PSYC 510 or instructors consent.
(3-0-3)

PSYC 513
Assessment in Rehabilitation Counseling
An orientation to the process and practice of assessing adults with disabling conditions for rehabilitation plan development and vocational decision-making. Introduction to test selection, administration, and interpretation through synthesis, integration, and evaluation of vocational assessment data used in rehabilitation counseling.
(3-0-3)

PSYC 514
Vocational Evaluation II: Report Development and Communication
The process of developing vocational evaluation and staffing reports. Gathering, analyzing, integrating, synthesizing and interpreting evaluation information. Development of feasible recommendations utilizing related sources of labor market/ occupational information. Prerequisite: PSYC 513.
(3-0-3)

PSYC 515
Vocational Evaluation Lab
Practical skills in vocational evaluation including application of work samples and situational assessment at a vocational evaluation site in the community. Prerequisites: PSYC 513, PSYC 514.
(3-0-3)

PSYC 516
Clinical Assessment III
Seminar and supervised training on cognitive and behavioral assessment and treatment. Research, psychometric characteristics, conceptual foundations of major assessment methods. Prerequisites: PSYC 526, may be concurrent.
(3-0-3)

PSYC 517
Performance Appraisal Seminar
The objectives of the seminar are to (1) provide a broad understanding of the multiple facets of performance appraisal, (2) understand research and advances in the field, and (3) understand the challenges and pitfalls of successfully implementing a performance appraisal system in an organization. Prerequisites: PSYC 529, PSYC 556.
(3-0-3)

PSYC 520
Adult Behavioral Medicine
Introduction to theoretical, clinical and research issues in adult behavioral medicine. Covers general perspectives of a biobehavioral approach, factors affecting adult health and illness, diagnostic and treatment approaches, and issues in research and application.
(3-0-3)

PSYC 523
Introduction to Theories of Psychotherapy
Introduction to various approaches to therapeutic intervention. The conceptual bases, history, methods, empirical foundations and applicability of important schools of therapeutic intervention will be considered. Prerequisite: PSYC 303 or equivalent.
(3-0-3)

PSYC 524
Child Behavior Therapy
Reviews current conceptualizations, assessment and treatment of childhood disorders from a behavioral-system perspective. Examines the impact of the family, school and other relevant systems on the development and treatment of child behavior problems.
(3-0-3)

PSYC 525
Child Psychopathology
Comprehensive understanding of child and adolescent psychopathology covering all DSM-IV disorders in infancy, childhood and adolescence. The epidemiology and etiology of each disorder from a developmental perspective is reviewed.
(3-0-3)

PSYC 526
Psychopathology
Critical examination of clinical and experimental research in psychopathology and diagnostic classification systems. Prerequisite: PSYC 303 or equivalent.
(3-0-3)

PSYC 529
Personnel Selection and Evaluation
Principles and techniques of employee selection and placement. Analysis of test data which will maximize the effectiveness of such techniques.
(3-0-3)

PSYC 530
Contemporary Issues in Industrial-Organizational Psychology
Survey of major theoretical formulations and current approaches to intervention techniques in the field of industrial-organizational psychology. Prerequisites: PSYC 529, PSYC 556.
(3-0-3)

PSYC 531
Organizational Attitudes and Behaviors Seminar
The course is an in depth study of factors that affect organizational behavior and attitudes (motivational theories). The various key attitudes and behaviors in organizations are defined and research relating to them is discussed (e.g., job satisfaction, organizational commitment, job involvement, turnover, absenteeism, and organizational citizenship). We also identify the stressors in todays employees lives and discuss some ways to manage them (e.g. job stress, work-family conflict, minority and immigrant workers). Prerequisite: PSYC 556.
(3-0-3)

PSYC 533
Clinical Practicum
Clinical assessment, therapy and/or consultation in a community-based mental health setting or medical facility for an average of 15 hours per week, per semester. Students obtain supervised experience in the provision of psychological services and related professional activities. Prerequisite: Must be in approved clinical placement site.
(Credit: Variable, 1-3 hours)

PSYC 534
Attachment Theory Throughout the Lifespan
Provides an in-depth understanding of attachment theory and research, as well as clinical applications throughout the lifespan. Prerequisite: Consent of instructor.
(3-0-3)

PSYC 535
Seminar In Personnel Selection
A critical review of advanced techniques in personnel selection. Includes such topics as validity generalization, utility analysis and applications of latent trait theory. Prerequisites: PSYC 511.
()

PSYC 536
Affective Disorders
Examination of current theory and research regarding affective disorders. Covers cognitive, behavioral, biological and cultural models. The relationship of affective symptomatology and diagnoses to other types of psychopathology are considered. Prerequisite: PSYC 526 or consent of instructor.
(3-0-3)

PSYC 540
Research Methods
This course prepares students for designing and interpreting empirical research. The collection of meaningful data, appropriate use of data analytic techniques, and the interpretation of data results are presented. Prerequisites: PSYC 545 and PSYC 546 or instructors consent
(3-0-3)

PSYC 545
Graduate Statistics I
Introduction to inferential statistics and statistical analysis of psychological data. Emphasis on hypothesis testing procedures and computer applications. Prerequisite: Basic course in elementary statistics.
(3-0-3)

PSYC 546
Graduate Statistics II
Statistical procedures used in the prediction and explanation of psychological data, including multiple regression and the analysis of variance. Emphasis on computer applications. Prerequisite: PSYC 545.
(3-0-3)

PSYC 548
Vocational Psychiatric Rehabilitation
An in depth review of models available to help people with severe mental illness obtain and maintain employment. Topics relating to vocational evaluation, work adjustment, placement, supported work models, and follow-up will be covered.
(3-0-3)

PSYC 549
Practicum in Rehabilitation Counseling
Seminar and supervised experience in rehabilitation counseling. Working two days in a rehabilitation facility and carrying a small client caseload geared toward the development of individual counseling skills. Prerequisites: PSYC 410, PSYC 523, PSYC 557.
(Credit: Variable)

PSYC 550
Couples Research and Therapy
Advanced seminar introduces students to empirically based interventions for couples. Presents clinically relevant and empirically derived material to better understand the importance of both technique and theory when intervening at a couples level.
(3-0-3)

PSYC 551
Design and Implementation of Experiments
Selection of appropriate designs, relevant control groups for experimental studies, researching relevant literature for experimental topics and applying appropriate statistical analyses. Prerequisites: PSYC 545, PSYC 546.
(3-0-3)

PSYC 552
Legal Issues in Human Resource Management
Seminar on the legal context of human resource management, focusing on equal employment opportunity laws. Will discuss how to design employee selection, evaluation and compensation systems that comply with U.S. federal laws and regulations. Prerequisite: PSYC 529.
(3-0-3)

PSYC 553
Family and Couples Therapy
Surveys the major theoretical perspectives for understanding and intervening with family and marital problems. Prerequisites: PSYC 506, PSYC 523, PSYC 526.
(3-0-3)

PSYC 554
Survey of Multivariate Statistics
Introduction to the major multivariate statistical procedures used in psychology; factor analysis, discriminant analysis, multivariate analysis of variance and canonical correlation. Prerequisites: PSYC 545, PSYC 546.
(3-0-3)

PSYC 555
Seminar in Industrial Training
Survey of various types of training and development programs used in industry. Also included are related major issues, specific techniques, assessment of training needs and evaluation of training programs. Prerequisites: PSYC 529, PSYC 556.
(3-0-3)

PSYC 556
Organizational Psychology
Theory and research concerning human behavior in formal organizations, communication nets, dynamics of managerial jobs; current ideas concerning organizations.
(3-0-3)

PSYC 557
Pre-Practicum in Rehabilitation Counseling
Seminar and observation at community rehabilitation facilities. Study of interviewing techniques, orientation to rehabilitation programs and field activities at rehabilitation agencies.
(3-0-3)

PSYC 558,559
Industrial Psychology Internship I, II
Supervised experience in psychological practices in an industrial setting.
(Credit: Variable)

PSYC 561
Group Counseling
Methods and techniques of various procedures in the counseling process. Advantages, limitations and unique applications of various approaches with specific client populations. Prerequisite: PSYC 523 or concurrent registration in PSYC 523.
(3-0-3)

PSYC 562
Job Placement
Techniques of job development, job analysis, job placement, job-seeking skills and follow-up. Includes affirmative action, manpower, and legislative programs involving job placement of special groups. Prerequisite: PSYC 563 or concurrent registration.
(3-0-3)

PSYC 563
Human Growth and Career Development
Presentation and discussion of human growth and career development theories across life span with special emphasis on persons with disabilities. Specific content includes Ericksons psychosocial development, Supers life span theory, Hollands theory of types, Trait-factor Theory, Krumboltzs social learning approach, Tiedemans spiritual perspective in career decision making, and family and system influences on vocational choice.
(3-0-3)

PSYC 564
Rehabilitation Research Seminar
The primary objective of this course is to help students become familiar with rehabilitation research, acquire the basic knowledge and skills for designing and conducting applied research, and develop a preliminary research proposal for their research project. A secondary purpose is to teach students to critically evaluate rehabilitation research. Specifically, this course covers an overview of various research designs, data analysis techniques, and the use of SPSS for statistical analysis. Prerequisite: PSYC 204
(3-0-3)

PSYC 566
Addictive Behaviors
A review of theoretical models of addiction from sociological, biological, and psychological perspectives. Critical examination of research methodology and clinical approaches. Emphasis on alcohol and drug abuse. Also covers substance abuse in special populations and other addictive behaviors.
(3-0-3)

PSYC 571
Seminar in Quantitative Psychology
Presentation and discussion of advanced topics in quantitative psychology. Specific content will vary from year to year. Topics such as factor analysis, multidimensional scaling, etc., will be discussed. May be taken more than once. Prerequisite: PSYC 554.
(3-0-3)

PSYC 573
Psychosocial Bases for Disability and Behavior
Presentation and discussion of psychological and social issues of disability and human behavior. Somatopsychology, field integrative theories and psychosocial aspects of disabilities. Prerequisite: Instructors consent.
(3-0-3)

PSYC 575
Adult Career Development and Vocational Behavior
Presentation and discussion of impact of disabilities on adult career development. Vocational development theories, occupational information and analysis, career counseling and research methodology. Prerequisite: Instructors consent.
(3-0-3)

PSYC 577
Professional and Ethical Issues in Rehabiliation Counseling Psychology
Presentation and discussion of issues related to professional and ethical practice in rehabilitation counseling psychology. History and philosophy of rehabilitation, professional and ethical standards, concerns in rehabilitation assessment, counseling, placement and independent living. Prerequisite: Instructors consent.
(3-0-3)

PSYC 578,579
Rehabilitation Internship I,II
Supervised experience in rehabilitation counseling. Prerequisite: PSYC 549.
(Credit: Variable)

PSYC 580
Seminar in Leadership
Reviews models and theories of leadership that cover group dynamics, power, influence, and conflict management as well as issues of diversity and gender. The focus is on research and practical issues in understanding leadership and its effectiveness. Prerequisite: PSYC 556.
(3-0-3)

PSYC 581
Neurophysiological Assessmen
Seminar and supervised training in neuropsychological assessment for adults. A review of neuroanatomy followed with a review of the conceptual foundations of brain-behavior relationships. Major assessment instruments will be covered. Prerequisites: PSYC 501, PSYC 510.
(3-0-3)

PSYC 582
Advanced Psychophysiology and Biofeedback
Reviews applications of physiological measures to practical problems. Clinical applications of biofeedback are discussed and demonstrated. Special emphasis on electromyographic techniques. Prerequisite: PSYC 501.
(3-0-3)

PSYC 583
Rehabilitation Engineering Technology I: Survey of Interdisciplinary Applications of RET
An overview of Assistive Technology (AT) used by people with disabilities. Includes contact with local AT sites, consumers and practicing professionals. Reviews specific AT applications for communication, mobility and control; national and local AT resources; and economics of AT development, marketing and service delivery. Design, engineering, and architectural issues relevant to people with disabilities are introduced. Prerequisite: PSYC 201.
(3-0-3)

PSYC 584
Rehabilitation Engineering Technology II: Access to Independence through Assistive Technology
Seminar designed for deeper exploration of assistive technology issues introduced in PSYC 583. Special focus on accessibility issues, technology outreach and awareness training; additional topics are chosen to reflect the specific interests of students in the class. Buildings are surveyed using ADAAG criteria for accessibility. Prerequisite: PSYC 583.
(3-0-3)

PSYC 585
Rehabilitation Engineering Technology III: Seminar in Applications of Assistive Technology
Seminar designed to accompany and enhance practical RET experiences, such as concurrent internship, employment or approved projects involving RET/AT applications. Case presentations of technology for independent living, issues of quality of outcome, alternatives/ appropriateness of technology solutions, ethics, emotional aspects of technology acquisition, independence/ dependency, and barriers to acquiring and deployment of AT are discussed. Prerequisite: PSYC 584.
(3-0-3)

PSYC 586
Concepts of Supervision
Explores formulations of the supervisory relationship and critical issues in the supervision of clinicians. Prerequisites: PSYC 506 and 533 or PSYC 578 and PSYC 579.
(3-0-3)

PSYC 588
Graduate Psychology Seminar
Reports and discussion of current problems and issues in psychology.
(3-0-3)

PSYC 589
Rehabilitation Internship III
Supervised experience in rehabilitation counseling. Prerequisite: PSYC 549.
(Credit: Variable)

PSYC 590
Psychiatric Rehabilitation
Class covers a wide range of topics including a review of the disease and disability models of mental illness, skills training components in treatment, incentive strategies for participants, transfer of learned skills to other situations, and cognitive rehabilitation strategies.
(3-0-3)

PSYC 591
Research and Thesis for MS Degree
(Credit: Variable)

PSYC 594
Special Projects
(Credit: Variable)

PSYC 597
Graduate Special Problems
(Credit: Variable)
(3-0-3)

PSYC 599
Clinical Internship
Participation in full-time internship accredited by the American Psychological Association, or in exceptional cases, approved by the Clinical Psychology Program faculty. Prerequisite: Ph.D. Comprehensive Exam.
(1-0-1)

PSYC 691
Research and Thesis for the PhD Degree

PSYC 710
Compensation and Benefit Application
Learn to design and modify a variety of compensation programs. Covers compensation basics, job analysis, job evaluation, compensation structure, incentive planning and more.
(1.5-0-1.5)

PSYC 711
Multilevel Data Analysis
Review of statistical methods for analysis of data at multiple levels of aggregation, such as individual and group level phenomena. The course covers conceptual issues, statistical models, and data analysis using computer software. Prerequisite: PSYC 546 or equivalent.
(1.5-0-1.5)

PSYC 712
Bayley Scales of Infant Development
Provides clinical skills required to administer, score, and interpret the Bayley Scales of Infant Development, 2nd Edition. Prerequisite: Consent of instructor.
(1-0-1)

PSYC 714
Assessment Centers
Develops the knowledge and skills needed for the design and implementation of assessment centers and other individual assessment methods. Prerequisite: PSYC 529.
(1.5-0-1.5)

PSYC 715
Organizational Assessment and Planning
This short course focuses on various processes and tools used in organizations to assess effectiveness, establishing priorities, and creating plans of action for change. Topics include the strategic planning process and the development and use of assessment tools such as organizational surveys and focus groups. Prerequisites: PSYC 556 and basic knowledge of statistics.
(1.5-0-1.5)

PSYC 716
Base Pay Management
This course provides an in-depth discussion of the principles, design, implementation and evaluation of an employee base-pay program. Topics include concepts for determining market position using salary surveys, the design of base pay structures, principles of merit pay, and the ongoing management of base pay programs. Prerequisite: PSYC 710.
(1.5-0-1.5)

PSYC 717
Variable Pay Programs
This course provides an in-depth review of variable pay programs with organizations, including incentives, recognition programs and teambased pay. Organization-wide, organizational unit, and individual programs will be discussed in terms of plan design, implementation and evaluation. Prerequisites: PSYC 710, PSYC 716.
(1.5-0-1.5)

PSYC 719
Fundamentals of Employee Benefits Programs
This course will address all aspects of employee benefits programs including government regulations, health and welfare plans, retirement plans and pay for time not worked. Case studies will be used to model real-life situations encountered by Human Resources professionals.
(1.5-0-1.5)

PSYC 782
Interdisciplinary Applications of Assistive Technology for Counselors
Intensive one-week overview of Assistive Technology with a focus on vocational applications. Includes visitations to working assistive technology sites, and lectures by consumers and specialists (including several of national prominence) in various areas of AT.
(1.5-0-1.5)

PSYC 783
Fundamentals of Vocational Applications of AT
Internet based distance class designed to follow PSYC 782 and further develop the students knowledge of AT and the skill in applying AT to solve practical problems for persons with disabilities. Applies knowledge of AT service delivery presented in PSYC 782 to issues in the students local region. Identifies AT needs of persons with disabilities and weaknesses, strengths, and gaps in local regions AT service delivery, with emphasis on vocational applications. Prerequisite: PSYC 782.
(1.5-0-1.5)

Undergraduate Courses Available to Graduate Students

PSYC 406
History and Systems of Psychology

PSYC 409
Psychological Testing

PSYC 410
Vocational Rehabilitation

PSYC 411
Medical Aspects of Disabling Conditions

PSYC 412
Multicultural and Psycholsocial Aspects of Disability

PSYC 414
Physiological Psychology

PSYC 420
Single-Subject Design and Applied Behavior Analysis

PSYC 426
Cognitive Processes

PSYC 431
Measurement of Attitudes

PSYC 435
Early Development

PSYC 436
Adult Development

PSYC 449
Practicum in Rehabilitation Services

PSYC 452
Personality Theory

PSYC 456
Engineering Psychology

Stuart School of Business

565 W. Adams St., Fourth Floor
Chicago, IL 60661
312.906.6500
degrees@stuart.iit.edu
www.stuart.iit.edu

Dean:
Harvey Kahalas

Program Contacts:

Master of Business Administration:
Krishna Erramilli

Environmental Management and Sustainability:
Krishna Erramilli

Finance:
John Bilson

Marketing Communication:
Krishna Erramilli

Master of Public Administration:
Roland Calia

Masters in Mathematical Finance:
Tomasz Bielecki

Ph.D. in Management Science:
M. Zia Hassan

Business at IIT

IIT Stuart School of Business provides intellectually rigorous business and management education at all levels, from baccalaureate to doctoral. All IIT Stuart programs are designed to educate tomorrow's global innovators through the unique concept of strategic competitiveness. Constructs including creativity, innovation, entrepreneurship, incisive decision-making, leadership, and sustainability are interwoven throughout coursework and professional development opportunities, offering students thorough preparation for the challenges of the Next Economy.

Established in 1969 with a gift from IIT alumnus and Chicago financier Harold Leonard Stuart, IIT Stuart offers a wide range of challenging business and management programs taught from a practical perspective, with an emphasis on analytic skills and the relation between business, management, and technology. AACSB-accredited programs include the M.B.A., Ph.D., four industry-responsive master's programs, and two bachelor of science in business programs. IIT Stuart also offers a Master of Public Administration (M.P.A.) degree.

Stuart faculty, in addition to their scholarly and teaching activities, are consultants to major national and international corporations. Their expertise has been called upon by local and federal government agencies, including the Environmental Protection Agency, National Institute of Standards and Technology, Metropolitan Sanitary District, Department of Housing and Urban Development, and Department of Energy. Many IIT Stuart students are also working professionals from Chicago's preeminent business, public administration, and finance communities.

Student resources include a Career Management Center with services available to current students and alumni; an Office of Student Services; the Stuart Business Library; and state-of-the-art technological resources, including more than 100 student workstations, interactive computer labs featuring the latest industry software, and a fully wireless downtown campus.

Because many Stuart students work full time, all graduate classes are offered as weekday evening classes at least once a year. Courses are also offered in the day-time and on weekends. All graduate programs are taught on Stuart's downtown campus at 565 West Adams Street in the heart of Chicago's vibrant financial district, the Loop.

Degrees Offered

Master of Business Administration (MBA)
Masters in Mathematical Finance (collaborative program with IIT's Department of Applied Mathematics)
Master of Science in Environmental Management and Sustainability
Master of Science in Finance
Master of Public Administration
Master of Science in Marketing Communication
Doctor of Philosophy in Management Science

Dual Degree Programs

M.B.A./M.S. in Environmental Management and Sustainability
M.B.A./M.S. in Marketing Communication
M.B.A./M.S. in Finance
M.B.A./Master of Public Administration

With the Institute of Design
M.Des/M.B.A.

With the IIT Chicago-Kent College of Law
J.D./M.B.A.
J.D./M.S. in Environmental Management and Sustainability
J.D./M.S. in Finance
J.D./Master of Public Administration

Graduate Certificate Programs

Business

Business Analytics
Innovation and Emerging Enterprises
Marketing Management
Environmental Management and Sustainability

Finance

Financial Toolbox
Fundamentals of Finance
Corporate Finance (post-graduate)
Entrepreneurial Finance Investments (post-graduate)
Financial Economics (post-graduate)
Financial Modeling (post-graduate)
Investments (post-graduate)
Risk Management (post-graduate)
Trading (post-graduate)

Public Administration

Nonprofit Management
Public Management
Public Safety and Crisis Management

Research Facilities

The downtown campus libraries are an open-stack collection of more than 525,000 volumes, including the holdings of the Stuart Business Library, the Chicago-Kent Law Library, and the Library of International Relations, which contains international materials in history, economics, political science, and law. IIT Stuart's downtown facility is equipped with three computer labs, offering more than 100 student workstations linked to the Internet and networked with IIT libraries. The computer labs offer access to a wide range of business software and resources. A Quantitative Research Lab provides an interactive learning environment, featuring simulated trading, investment analysis, and financial industry databases.

The **Center for Financial Markets** provides a unique focus on four interrelated spheres of knowledge needed by any professional who works for a financial intermediary or other capital market institution: financial markets, trading, financial engineering, and information technology. The Center supports Stuart's M.S. in Finance program and promotes scholarship and linkages to Chicago's financial industry, and assists faculty and students to contribute actively to projects in electronic trading, risk management, and new derivative products development. Michael Gorham, director, can be reached at 312.906.6520 or gorham@stuart.iit.edu.

The **Center for the Management of Medical Technology (CMMT)** is the IIT Stuart center for research, education and outreach, and dissemination to the community at large. It is directed by Professors Elie Geisler and Nilmini Wickramasinghe. The mission of the CMMT is to become an international center of excellence at IIT and to advance the state of knowledge in the areas of the management of medical technology, via education, research, and dissemination. For more information on the CMMT, please visit http://www.stuart.iit.edu/cmmt.

The **Center for Strategic Competitiveness** (CSC) is the nerve center for research and outreach activities of the Stuart School of Business, developing global partnerships to enhance innovation and creativity, and providing quality, high level executive education customized to meet discipline-specific demands. Our mission is develop Strategic Competitiveness into a approach to business that enhances the ability of individuals, organizations, and governmental units to respond proactively, innovatively and exceptionally to global market challenges in today's and tomorrow's economy.

The CSC provides a cross-discipline approach to competitiveness, combining psychology (decision making and leadership), design (creativity, innovation, and entrepreneurship), and engineering (sustainability). Our research and program efforts are developed within a network of partnerships, bringing together the knowledge and experience of executives, lawmakers, academics and experts in an array of fields. The CSC is tasked with the responsibility of making certain that the heart of the Stuart School of BusinessStrategic Competitivenessis always evolving and adapting to the present and future demands of global business. We do this, in part, through a major portfolio of research, symposia, public information, and public awareness of competitiveness issues developed in partnership with a variety of funders. Additionally, we provide training for individuals or groups through our custom executive education programs and course offerings, such as the Mini-MBA for Engineering, Science and Technology Professionals program.Director Harvey Kahalas can be reached at 312.567.3472 or csc@stuart.iit.edu.

The **Center for Sustainable Enterprise** has as its mission "to identify, develop, communicate, and help implement practical and equitable business strategies that advance the ecological sustainability of the Chicago area while fostering current and future economic viability." The Center brings together many disciplines at IIT in a collaborative relationship with business corporations, other academic institutions, government agencies, and members of the NGO community. George P. Nassos, director, can be reached at 312.906.6543 or gnassos@stuart.iit.edu.

Faculty

Thomas C. Anderson, Clinical Associate Professor and Associate Dean. B.S.B., M.S., University of Minnesota; M.S. Strategic Leadership, decision-making and women and minorities progression to postsecondary education.

Weslynne S. Ashton, Assistant Professor of Environmental Management and Sustainability. B.S., Massachusetts Institute of Technology, Environmental Engineering; M.S., Environmental Science; Ph.D., Yale University.

Siva Balasubramanian, Stuart Professor of Marketing and Associate Dean. B.S., M.B.A., Osmania University; Ph.D., State University of New York at Buffalo. Managing innovations/new product diffusion, marketing communications and research methods.

Martin L. Bariff, Associate Professor. B.A., M.A.S., Ph.D., University of Illinois, Urbana-Champaign. Impact of information technology on business strategy, organizational structure, management controls and human decision-making.

John Bilson, Professor of Finance and Director M.S. Finance Programs. B.Econ, Monash University, Australia; M.Econ, Monash University, Australia; Ph.D., University of Chicago. International finance, quantitative investment strategies.

Richard Bonaccorsi, Program Director and Senior Lecturer of Public Administration. B.A., DePauw University; M.I.M., American Graduate School of International Management (Thunderbird); Doctorate of Management, Case Western Reserve University, Management.

Sanford A. Bredine, Senior Lecturer, B.A., Trinity College, M.B.A., University of Chicago. Marketing and marketing communications.

Roland Calia, Interim Program Director and Senior Lecturer of Public Administration. M.S., Claremont Graduate School; Ph.D., University of Chicago.

Arjun Chakravarti, Assistant Professor of Management. B.A., University of Colorado, Economics and Cognitive Psychology; M.B.A. and Ph.D., University of Chicago, Management and Marketing.

Greg Chaudoin, Instructor. B.S.B.A./B.S. University of Louisville; M.S., University of Illinois, Urbana-Champaign; PhD. Cand., Illinois Institute of Technology. Portfolio theory and risk analysis and management.

Rick A. Cooper, Senior Lecturer of Finance. B.S., University of Chicago, mathematics; M.B.A. and Ph.D., Vanderbilt University, Finance.

Elizabeth J. Durango-Cohen, Assistant Professor. B.S., Sonoma State University; M.S., Ph.D., University of California, Berkeley. Supply chain management, supply chains, inventory and production planning, and capacity and pricing.

Krishna Erramilli, Professor and Director M.B.A. Program. M.S., M.B.A., University of Poona, India; Ph.D., University of Arkansas. International marketing strategy, foreign market-entry strategy, competitive advantages of global firms and growth strategies in emerging markets.

Eliezer Geisler, Distinguished Professor. Ph.D., Northwestern University. Organizational behavior, health care technology management, management of information and telecommunication technology, strategic management.

Joel Goldhar, Professor. B.Ch.E., Rensselaer Polytechnic Institute; M.B.A., Harvard University; D.B.A., George Washington University. Computer- integrated manufacturing, the impact of technology on business strategy.

Michael Gorham, Industry Professor and Director Center for Financial Markets. B.A., University of Notre Dame; M.S., University of Wisconsin; M.S., University of Florida; Ph.D., University of Wisconsin.

Charles T. Hamilton, Clinical Associate Professor. B.S., M.A.S., Ph.D., University of Illinois, Urbana-Champaign. Accounting education, the behavioral factors that influence audit judgment.

Geoffrey Harris, Assistant Professor. A.B., Ph.D., University of Chicago. Financial models and derivatives.

M. Zia Hassan, Professor and H. L. Stuart Dean Emeritus. B.Sc., University of Punjab (Pakistan); M.S., Ph.D., Illinois Institute of Technology. Effective organizations, strategic and quality issues in organizations.

Harvey Kahalas, Professor of Organizational Management, Dean. B.S., Boston University; M.B.A., University of Michigan; Ph.D., University of Massachusetts. Economic development, organizational competitiveness.

Nasrin R. Khalili, Assistant Professor and Academic Director, Environmental Management. B.Sc., M.S.P.H., Tehran University (Iran); Ph.D., Illinois Institute of Technology. Atmospheric chemistry, environmental impact analysis, environmental system analysis, and waste engineering.

Thomas W. Knowles, Professor Emeritus. B.S., Purdue University; M.B.A., Ph.D., University of Chicago. Mathematical and computer modeling.

Jianwen (Jon) Liao, Associate Professor. B.S., Northwestern University; M.A., People University of China; Ph.D., Southern Illinois University Carbondale. Entrepreneurial dynamics, venture formation, technology innovation and business planning.

Suzanne Mueller, Senior Lecturer. B.A., University of Rochester; M.B.A., University of Chicago. Strategic marketing, marketing research and new product development.

George P. Nassos, Industry Associate Professor. B.S., University of Illinois, Urbana-Champaign; M.S., M.B.A., Ph.D., Northwestern University. Sustainable strategies for the business enterprise, small wind turbine technology, renewable energy technologies.

Michael K. Ong, Professor. B.S. Physics, University of the Philippines, M.A. Physics, M.S. Applied Mathematics, Ph.D. Applied Mathematics, State University of New York at Stony Brook. Risk management- market risk, credit risk, operational risk and regulatory issues. International finance and capital markets. Financial risk modeling.

Scott Peters, Senior lecturer of Public Administration. B.A., Macalester College; J.D., Washington University; Ph.D., University of Illinois, Chicago.

Navid Sabbaghi, Assistant Professor Management Science. B.S., B.A., University of California, Berkeley; M.S., Ph.D., Massachusetts Institute of Technology. Supply Contracts, and capacity pricing in supply chain management.

Joing Sun, Assistant Professor. B.Sc., Shanghai Jiao Tong University; M.Eng., National University of Singapore; M.S., Ph.D., Carnegie Mellon University. The interaction of technology, firms, markets and the environment.

Nick T. Thomopoulos, Senior Lecturer. B.S., M.A., University of Illinois, Urbana-Champaign; Ph.D., Illinois Institute of Technology. Forecasting, inventory, assembly line systems.

Khairy A. Tourk, Professor. B.S., University of Alexandria (Egypt); M.A., Vanderbilt University; Ph.D., University of California, Berkeley. Evolution of the Asian enterprise, economics of the newly industrializing Asia.

John R. Twombly, Clinical Professor. B.S., University of Pennsylvania; M.B.A., Ph.D., University of Chicago. Financial and managerial accounting.

Benjamin Van Vliet, Lecturer. B.A., Calvin College; M.Sc., Illinois Institute of Technology.

Liad Wagman, Assistant Professor of Economics. B.A. and B.S., University of North Carolina, Mathematics and Computer Science; M.S., Stanford University, Computer Science; M.A., and Ph.D., Duke University Economics.

Haizhi Wang, Assistant Professor of Finance. B.S., Wuhan University, China; M.S., East China Normal University, China; Ph.D., Rensselaer Polytechnic Institute. Corporate Finance, Financial Institutions, Entrepreneurial Finance, Mergers and Acquisition, Strategic Alliances.

Tao Wu, Assistant Professor of Finance. B.A., Columbia University; Ph.D., University of Pennsylvania. Asset Pricing, investments, derivatives, fixed-income, international/ corporate finance.

Lulu Zeng, Assistant Professor of Finance. B.S., M.S., Tsinghus University, China; M.A. Ohio State University; M.S.I.A., Ph.D., Carnegie Mellon University. Asset Pricing, Portfolio Choice, DSGE and Real Estate Finance.

Admission Requirements

Admission to the Stuart School of Business is based on a profile combination of undergraduate GPA, GMAT test scores (some M.S. programs accept GRE scores in place of GMAT scores), and work experience. Applicants to all master's programs, including the M.B.A., must have, or are expected to have completed prior to enrollment, a four year undergraduate degree from an accredited institution. Applications are accepted throughout the year, and part-time students may enter most programs at the beginning of any semester. Applicants must submit essays, letters of recommendation, official transcripts, a recent GMAT score report, and a summary of work experience. Applicants from non-English-speaking countries must also submit TOEFL (Test of English as a Foreign Language) scores of at least 600 (250 computer/80 internet), unless they received an undergraduate or graduate degree from an accredited U.S. institution. Applicants who score less than 600 must enroll in English for International Students during their first semester.

Applicants to the Ph.D. program in management science must have completed a masters degree with a graduate level business core, or a Masters in Finance or equivalent degree. For applicants who have a masters degree but have not completed the business core, some prerequisite courses will be required.

Graduate Programs

All graduate programs in business are subject to continuous improvements. Prospective students are urged to refer to the Stuart Home page for the most current description of all programs and degree requirements.

Master of Business Administration (M.B.A.)

The M.B.A. program requires students to successfully complete 48 semester hour credits of 16 courses, 3 credit hours each. This includes the completion of ten core courses, two concentration electives, and four open electives. Courses are offered in the day-time, evenings, and weekends on the Downtown Chicago campus. The program is flexible and accomodates the needs of both full-time and part-time students.

Master of Business Administration Curriculum

Core Courses

MBA 501 Financial and Managerial Accounting
MBA 503 Organizational Behavior
MBA 505 Managerial Economics
MBA 507 Management Decision Making
MBA 509 Managerial Finance
MBA 511 Marketing Management
MBA 513 Operations Management
MBA 515 Strategic Information Systems
MBA 517 Strategic Competitiveness
MBA 525 Strategic and Functional Management

M.B.A. Concentrations

A concentration consists of a minimum of 6 credit hours in one of the following areas:

Financial Management
Innovation & Emerging Enterprises
Management Science
Marketing
Sustainability

Master of Science in Environmental Management and Sustainability

The Master of Science in Environmental Management and Sustainability integrates law, science and business to answer the increasing demand for a uniquely trained management professional who understands the many complex dimensions of environmental issues today, with an emphasis on sustainability. This program and its courses contributed significantly to Stuart's ranking in the Beyond Grey Pinstripes survey compiled by the Aspen Institute. This survey determines which schools are doing the best in integrating environmental and social sustainability into the business programs.

As it is critical that pollution prevention and environmental protection be addressed, this program focuses on both traditional environmental management as well as sustainability. Consequently, the program prepares students for executive and management environmental positions in corporations, government agencies, consulting firms and not-for-profit organizations. The program is supported by Stuart's Center of Sustainable Enterprise (CSE), founded in late 2000, which has a mission to realign stakeholders in business and community with endeavors that manage all forms of their capital – Natural, Human, Physical and Financial – resulting in consistent beneficial return on investment.

The master's curriculum consists of the equivalent of 11 full-semester courses: five required core courses, five electives of which two must be business electives, and one capstone course. Some of the technical courses have a prerequisite of college-level chemistry and calculus or their equivalents.

Required Courses (full semester)

EM 501 Environmental Law & Regulation
EM 502 Environmental Law & Compliance
EM 507 Industrial Ecology
EM 508 Pollution Control and Remediation
EM 530 Energy Management
MBA Elective I
MBA Elective II

Elective Courses

EM 517 Environmental and Occupational Risk Assessments and Management
EM 520 Issues in Global Sustainability
EM 554 Environmental Economics and Climate Change
EM 597 Independent Study

Capstone

EM 590 Business Strategy: The Sustainable Enterprise

Master of Science in Finance

The M.S. Finance program requires that participants complete a total of 11 semester courses. The typical program will consist of six core cores and five elective courses. However, students may request that they be allowed to substitute an elective course for a core course if they can demonstrate to the program director that they have already mastered the material in the core course.

Core Classes

MSF 501 Mathematics with Financial Applications
MSF 502 Statistical Analysis in Financial Markets
MSF 503 Financial Modeling
MSF 504 Valuation and Portfolio Management
MSF 505 Futures, Options and OTC Derivatives
MSF 506 Financial Statement Analysis

Elective Classes Elective classes are organized into concentrations. Students who complete one or more courses within a particular concentration will have the concentration recognized on their degree and on official transcripts.

Corporate Finance

MSF 534 Corporate Finance
MSF 535 Investment Banking

Financial Economics

MSF 564 Financial Theory
MSF 565 International Finance Theory

Financial Econometrics

MSF 566 Financial Time Series Analysis
MSF 567 Bayesian Econometrics

Financial Engineering

MSF 524 Models for Derivatives
MSF 525 Interest Rates, Term Structure and Credit Models

Financial Markets

MSF 591 Global Financial Markets
MSF 593 Global Investment Strategies

Financial Programming

MSF 574 .NET and Database Management
MSF 575 C++ with Financial Applications

High Frequency Finance

MSF 576 OOP and Algorithmic Trading Systems
MSF 577 High Frequency Trading Systems

Investment Management

MSF 545 Structured Fixed Income Portfolios
MSF 546 Quantitative Investment Strategies

Risk Management

MSF 554 Market Risk Management
MSF 555 Credit Risk Management

Alternative Investments

MSF 547 Alternative Investment Vehicles
MSF 595 Commodities and Managed Futures

Trading

MSF 584 Equity and Equity Derivatives Trading
MSF 585 Fixed Income Options and Securities

Entrepreneurial Finance

MSF 594 Entrepreneurial Finance
MSF 595 The Venture Capital Process

Core Requirement

All M.S. Finance students must complete the six core classes unless they have obtained written permission from their academic advisor to substitute an alternative class for a core class.

Course Substitutions

To the extent that students have completed commensurate coursework or professional experience, substitutions to the required curriculum may be permitted, with the approval of the academic advisor. Qualified students may substitute courses from the M. in Mathematical Finance for elective courses in the M.S. Finance program.

Free Electives

Up to two graduate level electives may be taken from outside the courses prescribed above. These electives may be taken from other offerings at the Stuart School of Business, the Chicago-Kent College of Law, or Main Campus graduate programs, provided that: (1) they are consistent with the M.S. Finance program objectives; (2) they have been approved, prior to the student's registration, by the M.S. Finance program director or the student's academic advisor.

Students may also transfer up to two classes from a graduate program at another AACSB accredited university if the student has not used the classes to satisfy the requirements for a degree at the university. Additional classes may be transferred with the permission of the program director.

Prerequisite Courses

Some students may be required to take prerequisite courses in mathematics, statistics, or computer programming before being admitted to a graduate course. Undergraduate course offerings, which typically are listed with a primary numeral of four or below (i.e. FM 492) cannot be used as free electives in the M.S. Finance program.

Master's in Mathematical Finance

The M. in Mathematical Finance is a degree offered jointly by the Stuart School of Business and the IIT Department of Applied Mathematics. Students are required to complete a total of 11 semester courses, including seven core courses and 4 elective courses.

Core Classes

MSF 515 Futures, Options and OTC Derivatives
MSF 543 Computational Finance
MATH 542 Stochastic Processes
MATH 548 Mathematical Finance I
MATH 565 Monte Carlo Methods in Finance
MATH 582 Mathematical Finance II
MATH 586 Theory and Practice of Fixed Income Modeling

Elective Classes from the Department of Applied Mathematics

MATH 512 Partial Differential Equations
MATH 513 PDE's for Finance
MATH 540 Probability
MATH 543 Introduction to Stochastic Analysis
MATH 544 Stochastic Dynamics
MATH 545 Stochastic Partial Differential Equations
MATH 546 Introduction to Time Series
MATH 566 Multivariate Analysis
MATH 567 Advanced Design of Experiments
MATH 569 Statistical Learning
MATH 577 Computational Mathematics I
MATH 578 Computational Mathematics II
MATH 579 Complexity of Numerical Problems
MATH 583 Quantitative Modeling of Derivative Securities
MATH 584 Mathematical Portfolio and Investment Theory
MATH 587 Theory and Practice of Modeling Credit Risk and Credit Derivatives
MATH 589 Numerical Methods for PDEs
MATH 590 Meshfree Methods

Elective Classes from the Stuart School

MSF 524 Models for Derivatives
MSF 525 Interest Rates, Term Structure and Credit Models
MSF 545 Structured Fixed Income Portfolios
MSF 546 Quantitative Investment Strategies
MSF 554 Market Risk Management
MSF 555 Credit Risk Management
MSF 556 Enterprise Risk Management
MSF 564 Financial Theory
MSF 565 International Finance Theory
MSF 566 Financial Time Series Analysis
MSF 567 Bayesian Econometrics
MSF 574 .NET and Database Management
MSF 575 C++ with Financial Applications
MSF 576 OOP and Algorithmic Trading Systems
MSF 584 Equity and Equity Derivatives Trading
MSF 585 Fixed Income Options & Securities

Core Requirement

All Mathematical Finance students must complete the seven core classes unless they have obtained written permission from their academic advisor to substitute an alternative class for a core class.

Course Substitutions

To the extent that students have completed commensurate coursework or professional experience, substitutions to the required curriculum may be permitted, with the approval of the academic advisor.

Electives

At least two electives must be taken in Finance and at least one elective must be taken in Math from the elective options listed above.

Free Electives

One graduate level elective may be taken from outside the courses prescribed above. These electives may be taken from other offerings at the Stuart School of Business, the Chicago-Kent College of Law, or Main Campus graduate programs, provided that: (1) they are consistent with the M. in Mathematical Finance program objectives; (2) they have been approved, prior to the student's registration, by the M.S. Finance program director or the student's academic advisor.

Students may also transfer up to two classes from a graduate program at another accredited university if the student has not used the classes to satisfy the requirements for a degree at the university. Additional classes may be transferred with the permission of the program director.

Prerequisite Courses

Some students may be required to take prerequisite courses in mathematics, statistics, or computer programming before being admitted to a graduate course. Undergraduate course offerings, which typically are listed with a primary numeral of four or below (i.e. FM 492) cannot be used as free electives in the M.S. Finance program.

Master of Science in Marketing Communication

The new technologies of the 21st century have totally transformed both the business model and vehicles companies use to communicate with their various stakeholders. Stand alone elements like advertising and public relations are no longer effective in and of themselves. Today, marketing products, services, and ideas to the public must synthesize all of these activities into the cohesive whole called integratedmarketing communication with the ability to surround the prospect with the brand message.

As one of a handful of marketing communication programs offered at an accredited business school, IIT Stuart's Marketing Communication program will effectively prepare you for this exciting and challenging environment. Our program is intended to marry the core critical thinking values of creativity, innovation, and design taught by our M.B.A. faculty, with the practical state of the art applications taught by our extensive and talented faculty of practicing professionals who teach the skills necessary to thrive in today's rapidly evolving technology-focused environment.

All this is designed to prepare you for a career developing and implementing creative innovative marketing strategies with the potential to transform attitudes and ultimately product performance in the marketplace.

The M.S. curriculum consists of eleven 3 hour courses, structured to emphasize strategies for transformational leadership. Students will be required to take 6 core courses plus the Practicum, plus the equivalent of four Elective courses.

Core Courses

MC 510 Marketing Foundations: The Art of Marketing
MC 514 Marketing Communication Plan: Developing Transformative Marketing Strategies
MC 516 Marketing & Advertising Research: Building Consumer Insight Through Research
MC 520 Understanding the Target Audience
MC 522 Media Strategy and Implementation for the 21st Century
MC 524 Creative Strategies
MC 536 Practicum

Electives

MC 503 Strategic Brand Management
MC 533 Database and Direct Marketing
MC 535 Sales Promotion and Alternative Media Techniques
MC 546 Communications Strategies for Emerging Technologies
MC 554 Customer Relationship Management
MC 555 Marketing Analyses
MC 563 Web Page Design

Master of Public Administration

The graduate program in Public Administration (M.P.A.) emphasis the fields of urban government and community affairs, policy analysis, organization and management of work, public finance, public safety and nonprofit management.

IIT has offered educational programs in public administration since the 1940s and has awarded the Master of Public Administration (M.P.A.) degree; the most widely recognized professional credential, since themed-1960s. Building on the foundations laid by former department faculty members Herbert A. Simon (Nobel Laureate), Victor Thompson and Donald Smithburg, the current program continues to present a practical focus on the characteristics and responsibilities of the effective governmental manager. Nearly all public administration students have substantial work experience in public or nonprofit agencies. Most courses meet during the evening hours on IIT's Downtown Campus near transportation facilities to accommodate the needs of themed-career public service professional that constitute most of the programs student body.

The M.P.A. Program offers specializations in Public Management, Nonprofit Management, Public Safety and Crisis Management and Public Works.

Master of Public Administration

32 credit hours
Preliminary Exam

The Master of Public Administration program, which is designed for the working professional, combines rigorous instruction with a practical orientation toward public and nonprofit management and policy analysis. Students encounter this balance between the academic and the practical in the teaching faculty, course materials and classroom exercises. The program emphasizes both administrative knowledge and managerial skills related to the formulation of policy, the acquisition of human and financial resources, application of sound methods of organization and management, and the development and execution of effective implementation strategies. The curriculum allows students a significant amount of flexibility in selecting courses that meet their personal educational and professional objectives, while also assuring them of a sound foundation in all key areas of the discipline.

The M.P.A. degree requires a minimum of 32 credit hours of graduate work. No more than six credit hours may be taken in IIT courses numbered between 400 and 499. A maximum of nine credits of graduate-level coursework may be transferred from another accredited university if these have not been used toward a degree and upon approval of the student's advisor and Program Director. The normal program of study requires completion of the following core courses:

PA 501 Introduction to Public Administration
PA 502 Complex Organizations
PA 503 Public Administrative Law **OR**
PA 505 The Law and the Nonprofit Sector
PA 522 Public Personnel Administration
PA 532 Principles and Practices of Public Finance
PA 542 Strategic Planning
PA 509 Practicum in Policy Analysis

In addition, the program requires completion of PA 510 Managerial Communications for the students who do not place out of that course pursuant to department procedures.

Students must complete a minimum of 32 semester hours. Elective courses may be selected from courses in public administration or such other fields as architecture, business, city and regional planning, civil engineering, computer science, design, environmental engineering, humanities, psychology, social sciences or law. These courses are to be chosen with the help of his/her advisor to help further the student's career objectives. Prior to enrolling for their second semester, full-time students are required to successfully complete a preliminary exam in public administration theory and organization theory. Part-time students must take the preliminary exam before enrolling for their fifth course. Students are urged to begin their program with courses in public administration theory and organization theory in preparation for this exam. A capstone project is part of the PA 509 Practicum in Policy Analysis course, and is required for this degree.

Master of Public Administration with Public Management Specialization

In 2007, the GPPA initiated a Public Management specialization. Students interested in a career in public management take the regular M.P.A. core curriculum and up to four to five electives from the public management courses offered in the program. The program is designed for the working professional combining rigorous instruction with practical orientation toward public management.

Master of Public Administration with Nonprofit Management Specialization

Students from nonprofit organizations and students interested in the nonprofit sector take the regular M.P.A. core curriculum and up to four to five electives from the nonprofit courses offered in the program. This program is designed for the working professional combining rigorous instruction with practical orientation toward nonprofit management and policy analysis.

Master of Public Administration with Public Safety/ Crisis Management Specialization

Students take the regular M.P.A. core curriculum and up to four to five electives from the public safety and crisis management courses offered in the program. This program is designed for the working professional combining rigorous instruction with practical orientation toward public safety management and policy analysis.

Master of Public Administration with Public Works Specialization

In 1982, the GPPA initiated a public works specialization in conjunction with IIT's Department of Civil and Architectural Engineering, the Chicago Metropolitan Chapter of the American Public Works Association (APWA), and the Education Foundation of the APWA. Students from public works agencies, especially those with engineering and technical backgrounds, take the regular M.P.A. core curriculum and PA 551 (Public Infrastructure Management) and may also take appropriate engineering courses for elective credit. In addition, the M.P.A. program cooperates with the Department of Civil and Architectural Engineering in their offering of a Master of Public Works (M.P.W.) degree.

Certificate Programs

Three graduate certificate programs are offered in public administration. These programs provide students with a post-baccalaureate knowledge of an area of specialization with public administration. Students in these programs register as certificate students. Certificate programs require a set of four courses. Students who are admitted to a master's degree program may apply coursework previously taken in a certificate program toward the requirements for the master's degree.

Public Management

This program is designed for those interested in increasing their knowledge and skills in public management but do not currently have the time to pursue an M.P.A. with a specialization in Public Management.

The student will take at least 3 of the courses described below:

PA 539 Local Government Management and Public Safety
PA 541 Performance Measurement in Nonprofit and Public Management
PA 560 Information Technology in Public Administration
PA 508 Seminar in Public Management
PA 513 Public Policy Analysis and Evaluation
PA 531 Governmental Accounting and Budgeting
PA 533 Advanced Financial Management for the Public and Nonprofit Sectors
PA 556 Management Strategy and Tools in the 21st Century
PA 562 Urban and Metropolitan Government

AND 1 M.P.A. course

Recommended is PA 502 Complex Organizations

With permission from the M.P.A. program director, the student may choose another course.

Nonprofit Management

This program is designed for those interested in increasing their knowledge and skills in the nonprofit sector but do not currently have the time to pursue an M.P.A. with a specialization in Nonprofit Management.

The student will take at least 3 of the courses described above and below:

PA 505 The Law and the Nonprofit Sector
PA 534 Financial Management of Nonprofit hspace5ptOrganizations
PA 535 Resource Development in the Nonprofit Sector
PA 541 Performance Measurement in Nonprofit and Public Management
PA 543 Public Policy, Nonprofits and Philanthropy
PA 565 The Nonprofit Sector
PA 566 Nonprofits and the Public Sector
PA 570 Social Capital and the Community

AND take 1 M.P.A. course

Recommended is PA 502, Complex Organizations

With permission from the M.P.A. program director, the student may choose another course.

Public Safety and Crisis Management

This program is designed for those interested in increasing their knowledge and skills in the public safety field but do not currently have the time to pursue an M.P.A. with a specialization in Public Safety Management.

The student will take 3 of the courses described below:

PA 536 Strategy and Structure: Homeland Security
PA 537 Homeland Security/Crisis Management
PA 538 Information Systems Security/Cyber-crime
PA 539 Local Government Management and Public Safety
PA 553 Public Safety Administration
PA 588 Incident Response, Disaster Recovery and Business Continuity

AND 1 M.P.A. course:

Recommended is PA 502, Complex Organizations

With permission from the M.P.A. program director, the student may choose another course.

Doctor of Philosophy in Management Science

14 courses:
Four required core courses
(12 semester credit hours)
Eight elective courses in area of interest
(24 semester credit hours)
Two advisor-approved open electives
(6 semester credit hours)
Optional practicum in teaching and curriculum
(1 semester credit hour)
Qualifying exam upon completion of core coursework
Comprehensive exam upon completion of all coursework
Research (21 semester credit hours)
Submission of dissertation
Oral defense of dissertation

The Ph.D. in Management Science Program at IIT prepares students and working professionals for careers in university teaching and research and for executive and management positions in business, government and consulting firms. Approximately half of the program's graduates have chosen academic careers.

The program is selective and small with a high degree of interaction between faculty and students and a mentor relationship with a faculty adviser. The Ph.D. Area Committee carefully matches the interest of the student with the expertise of the faculty member. The program offers two concentrations: Operations and Finance.

Operations Concentration

At the IIT Stuart School of Business, operations is taught as the design and implementation of systems that improve the effectiveness and efficiency of organizations. Candidates in the program learn to understand how the optimization of resourcespeople, technology, finance and informationcan be effectively integrated for competitive advantage. Management today realizes the value of operations in any organization, whether it produces products or provides services.

Areas of research in operations pursued by faculty and students include design of quality systems, strategic quality management, forecasting, materials management, scheduling, optimization, capacity planning, manufacturing strategy, and strategic management of manufacturing firms.

Finance Concentration

The Ph.D. with a finance concentration is offered only as part of the Master of Science in Finance/Ph.D. Dual Degree Program, unless the applicant has earned a graduate degree that is equivalent to the program at IIT Stuart, as determined by the program director. Students in this dual degree program may earn both an M.S. in Finance and a Ph.D. in Management Science.

Graduates of the Ph.D. program who concentrate in finance have a wide choice of careers. In addition to a traditional career in teaching and research, graduates may also work in investment and commercial banking, trading and risk management. Dissertation research in this area has been focused on risk modeling, financial time series analysis, and investment analysis.

Ph.D. Program of Study

IIT requires that at least two semesters of study be completed on a full-time basis. The semesters need not be consecutive but must occur within the six years prior to the awarding of the degree. Research may be done off campus if suitable arrangements for supervision can be made. Upon a student's admission to the program, the dean of the Stuart School appoints the student an advisor. The advisor helps the student to formulate an overall plan of study, including coursework, reading, independent study, and a plan of research, which must be approved by the dean of the Stuart School.

Upon completion of core coursework, a written qualifying examination is required. The qualifying examination is diagnostic in purpose, and the school determines its form and scope. After completion of all coursework, a written comprehensive examination is required. This examination is a rigorous review of the level of competency achieved as a result of the entire program of graduate study (except for the dissertation) as approved by an advisory committee and specified in the program of study. There may also be an oral component to the comprehensive examination. Qualifying or comprehensive examinations may be taken only twice. If the student fails the qualifying exam on the second attempt, the student will be transferred from the Ph.D. program to a Stuart Master's program. If the student fails the comprehensive exam on the second attempt, the student will be released from the Ph.D. program.

When a student is ready to begin research, he or she is appointed a mutually acceptable research advisor by the dean of the Stuart School. A research project must be an original investigation of high quality, and the results must be submitted in the form of a dissertation and of a related publishable paper. After submitting a completed dissertation, the student will appear before an oral thesis defense committee composed of at least four full-time faculty members, one of whom will be a representative from outside the student's field. There must be a period of at least one semester between the date of the comprehensive examination and the final defense.

Students may take up to six years to complete the degree. After six years, students may petition for an extension, but they must reapply to the program and may be required to retake a comprehensive examination. A cumulative GPA of 3.0/4.0 in an approved program of study is required for the Ph.D. program.

Students entering the program may transfer up to two classes from a graduate program at another AACSB accredited university if the student has not used the classes to satisfy the requirements for a degree at the university. Additional classes may be transferred with the permission of the program director.

Some students may be required to take prerequisite courses in mathematics, statistics, or computer programming before being admitted to a graduate course. Undergraduate course offerings, which typically are listed with a primary numeral of four or below cannot be used as freed electives in the Ph.D. program

Doctor of Philosophy in Management Science Curriculum

Operations Management Core

ECON 570 Theory of the Firm
MSC 530 Probability and Statistics
MSC 538 Simulation and Data Analysis
MSC 560 Optimization Techniques I

Operations Management Elective Courses

MSC 534 Queuing Theory
MSC 543 Time Series
MSC 550 Topics in Quality Management
MSC 562 Optimization Techniques II
MSC 564 Optimization Techniques III
MSC 568 Supply Chain Methods
MSC 574 Scheduling Theory
MSC 576 Practicum in Teaching and Curriculum Skills
MSC 595 Operations Management Seminar

Finance Elective Courses

MSF 503 Financial Modeling
MSF 506 Financial Statement Analysis
MSF 523 Marketing of Financial Products
MSF 524 Models for Derivatives
MSF 525 Interest Rates, Term Structure and Credit Models
MSF 534 Corporate Finance
MSF 535 Investment anking
MSF 545 Structured Fixed Income Portfolios
MSF 546 Quantitative Investment Strategies
MSF 554 Market Risk Management
MSF 555 Credit Risk Management
MSF 564 Financial Theory
MSF 565 International Finance Theory
MSF 566 Financial Time Series Analysis
MSF 567 Bayesian Econometrics
MSF 574 .NET and Database Management
MSF 575 C++ with Financial Applications
MSF 576 OOP and Algorithmic Trading Systems
MSF 584 Equity and Equity Derivatives Trading
MSF 585 Fixed Income Trading Strategies
MSF 591 Global Financial Markets

Elective Courses from the Department of Applied Mathematics

(Participation in Mathematical Finance classes will require the approval of the director of the M. in Mathematical Finance program and the course instructor. Participants who plan to take mathematical finance electives should consult with their program director regarding appropriate core classes.)

MATH 512 Partial Differential Equations
MATH 513 PDE's for Finance
MATH 542 Stochastic Processes
MATH 543 Introduction to Stochastic Analysis
MATH 544 Stochastic Dynamics
MATH 565 Monte Carlo Methods in Finance
MATH 582 Mathematical Finance
MATH 583 Quantitative Modeling of Derivative Securities
MATH 584 Mathematical Portfolio and Investment Theory
MATH 586 Theory and Practice of Fixed Income Modeling
MATH 587 Theory and Practice of Modeling Credit Risk and Credit Derivatives
MATH 589 Numerical Methods for PDEs

Dual Degree Programs

Several dual-degree programs are offered, including programs in which enrollees are eligible to earn a law degree from IIT Chicago-Kent College of Law. To help plan a program of study, students will be assigned advisors from both programs in which they are studying. Simultaneous enrollment is required for varying periods of time, depending on programs. Students should consult advisors from both programs for further information. Candidates for a dual-degree program must apply to and be accepted by each program separately. Current LSAT scores are required for admission to Chicago-Kent College of Law. Current GMAT or GRE scores are required by the Stuart School of Business, but current LSAT scores may be substituted in some programs. Interested students should contact program advisors from either program for other specific requirements.

All graduate programs in business are subject to continuous improvements including dual-degree programs. Prospective students are urged to refer to the Stuart Home page for the most current description of all programs and degree requirements.

M.B.A./M.S. in Environmental Management and Sustainability

The M.B.A./M.S. in Environmental Management and Sustainability is designed to prepare professionals for management-level positions in corporations, government agencies and consulting firms. This program requires 22 semester courses of 3 credits each as specified by the Program Directors to fulfill this dual-degree program. The courses will be drawn from the M.B.A. and the M.S. in Environmental Management Programs. This dual-degree program is typically completed in three years of full-time study or in five years of part-time study. Dual enrollment can reduce degree requirements by as many as five courses.

M.B.A./M.S. in Marketing Communication

The M.B.A./M.S. in Marketing Communication program is designed to prepare students and working professionals who wish to pursue a career in marketing at the managerial or executive level at advertising agencies, public relations firms, and marketing firms or in the functional area of marketing at corporations. A combination of 24 M.B.A. and M.S. in Marketing Communication courses makes up the dual curriculum. Both degrees are usually earned in three years of full-time study or in five years of part-time study. Dual enrollment can reduce degree requirements by as many as three courses.

M.Des./M.B.A.

Offered in conjunction with the IIT Institute of Design, the Master of Design / Master of Business Administration (M.Des./M.B.A.) dual degree program combines graduate professional education in both design and business. The first program of its kind in the world, IIT's M.Des./M.B.A. marks an important milestone in the coevolution of design, management, and innovation. Please consult the M.B.A. Program Director or the Stuart website for the current requirements for this dual-degree program.

M.B.A./M.P.A.

The Master of Public Administration program, designed for the working professional, emphasizes the formulation of policy, the acquisition of human and financial resources, and the application of sound methods of management in public and nonprofit organizations. The M.B.A./M.P.A. is ideal for students who intend to work in an environment that combines aspects of both public- and private-sector management and for those who expect to move between business and government positions during their career. Both degrees are usually earned in three years of full-time study or in five years of part-time study. Please consult the M.B.A. Program Director or the Stuart website for the current requirements for this dual-degree program.

J.D./M.S. in Environmental Management and Sustainability

The Master of Science in Environmental Management and Sustainability integrates managerial and technical skills into Chicago-Kent's renowned Environmental and Energy Studies Program. This dual program is particularly well integrated because the two schools have offered it for about 10 years and have continually updated the courses and options for the students. Both degrees are usually earned in about three and a half years of fulltime study or in five to six years of part-time study. Dual enrollment is required in order to have courses apply to both programs and reduce the total course load.

J.D./M.B.A.

The J.D./M.B.A. program is offered in conjunction with Chicago-Kent College of Law. The management expertise and business skills that participants acquire in the M.B.A. program can be important skills in the legal profession. A solid understanding of the business world can be invaluable in many areas of law, especially for corporate attorneys or legal/management consultants. An M.B.A. degree prepares lawyers for management responsibility in their firm. Please consult the M.B.A. Program Director or the Stuart website for the current requirements for this dual-degree program.

B.S./M.P.A.

The requirements for the B.S. in Political Science/M.P.A. degree may be completed in five years of full-time study. Qualified students interested in careers in the public sector are encouraged to begin their preparation at the undergraduate level and follow a course of study that will allow them to move directly into the M.P.A. program. For detailed information, prospective students should contact the the coordinator of the B.S./M.P.A. program.

J.D./M.P.A.

A J.D./M.P.A. program, offered in conjunction with IIT's Chicago-Kent College of Law, allows students to receive both a Juris Doctor degree and a Master of Public Administration degree in a reduced time period, depending on undergraduate preparation. This program is particularly valuable for administrators whose work is guided and circumscribed by a web of legislation, rules and judicial decisions, including persons interested in city management, labor and personnel work, police administration, and public policy analysis. Students must be admitted to both programs separately. For detailed information, prospective students should contact the coordinator of the J.D./M.P.A. program, Professor Scott Peters.

M.B.A./M.P.A.

Many managers wish to increase their understanding of and ability to operate effectively in both the public and private sectors. This desire flows from the extensive interaction between the two sectors in such areas as procurement, contracting, consulting and economic development, as well as opportunities for career mobility. The dual-degree M.B.A./M.P.A. program reduces course requirements by as many as six courses from the requirements for the two degrees taken separately. For detailed information, prospective students should contact academic advisors and the program director at the Stuart School of Business.

Course Descriptions

Numbers in parentheses represent class, lab and total credit hours, respectively.

ECON 570
Theory of the Firm
The basic objective of this course is to present in mathematical form the basic theories that comprise what is accepted today as orthodox microeconomics. Topics covered are economic models, comparative statistics applied to supply and demand, consumer choice, the economics of production, factor markets, market structure and resource allocation.
(3-0-3)

EM 501
Environmental Law and Regulation
This course will introduce students to the major federal and state statutes and regulatory programs that govern pollution from industrial, commercial, and public sources. The course will emphasize the organization of the government regulatory agencies, the techniques of environmental regulation, the interplay of federal and state environmental regulation, environmental enforcement, and environmental litigation. The National Environmental Policy Act (NEPA), the Clean Water Act, Safe Drinking Water Act, Clean Air Act, Toxic Substances Control Act (TSCA), Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Endangered Species Act will be the main statutes used to illustrate the workings of the pollution control statutes. The role of environmental law in the international arena will also be discussed.
(3-0-3)

EM 502
Environmental Law and Compliance
This course begins with an analysis of The Solid Waste Disposal Act (and Resource Conservation and Recovery Act, RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It will then familiarize students with an environmental manager's duties in permitting, reporting, record keeping and sampling. It emphasizes a systematic approach to identifying obligations with respect to regulated media and developing appropriate responses. Obligations under United States environmental laws, their relationship to state and local laws, and state and local obligations are considered as a model for analysis and response. Practical applications of permitting, monitoring, record keeping and reporting will also be included. Prerequisite: EM 501.
(3 hours)

EM 507
Industral Ecology
This course introduces the students the philosophy of Industrial Ecology, and how this systems-based approach can move society toward a more sustainable future. Industrial Ecology is an interdisciplinary field involving technology (science and engineering), public policy and regulatory issues, and business administration. The major goal of this course is to promote creative and comprehensive problem solving as it might be applied to product, business and systems models. The course introduces tools such as Industrial Metabolism, Input-Output Analysis, Life Cycle Assessment, and Design for the Environment. Individual and team projects are a significant part of the learning experience in this course.
(3 hours)

EM 508
Pollution Control and Remediation
This course provides a comprehensive analysis of the pollution prevention and cleaner production processes. Waste minimization, recycling, and reuse options are examined and applicable control technologies to industrial waste minimization and treatment are discussed. Relevant remediation options including effective use of technologies for clean up of contaminated sites are reviewed through extensive use of case studies. Prerequisite: College level Chemistry and Calculus.
(3 hours)

EM 517
Environmental and Occupational Risk Assessments and Management
The course provides an overview of the tools and techniques used to (1) assess environmental (human health), ecological, and occupational risks associated with exposure to environmental pollutants resulting from natural phenomena, economic development and industrial growth, (2) examine current risk management and mitigation methods and strategies, and (3) design visionary risk management strategies grounded on a framework of operations in line with the principles of sustainable development.
(3-0-3)

EM 520
Issues in Global Sustainability
The increasing complexity of environmental problems warrants an integrated, multidisciplinary approach to developing management strategies for local, regional and global sustainability. This course provides an overview and analysis of some of the most significant environmental issues facing communities across the planet including water availability, air pollution, ecosystem degradation and climate change. The objectives of course are to 9!0 identify and evaluate the severity of current and emerging environmental challenges impacting societies around the world; (2) understand the linkages among scientific, economic and social dimension of these issues; (3) gain a real-world perspective on developing viable technical, policy and business solutions to these problems; and (4) practice effective research and communications skills by collaborating on a group project.

EM 530
Energy, Environment, and Economics
This course deals with the linkage of energy, environmental and economic issues. The impact of energy supply and end-use on human well-being and the ecosystem is covered. It also includes a comprehensive approach to the resolution of resource, technical, economic, strategic, environmental, socio- and geopolitical problems of the energy industries. In addition, pathways to a sustainable global energy system are presented.
(3 hours)

EM 554
Environmental Economics and Climate Change
An overview of the modeling market process is provided focusing on externalities, environmental problems and environmental quality. Economic solutions to environmental problems are discussed using a market approach which includes modeling emission charges, modeling a product charge, modeling per unit subsidy on pollution reduction and modeling pollution permit trading systems and practice. The course examines intuition economic solutions to address environmental problems such as climate change, global warming and water scarcity.
(3-0-3)

EM 590
Business Strategy: The Sustainable Enterprise
This course integrates environmental management issues with use of strategic planning tools for assessing and responding to the driving forces of the "next" economy: globalization, technology, demographics and the environment. The course looks at the challenge of corporations competing in the global economy of the new millennium in such a way that will allow the planet to support them indefinitely. Emphasis is on the company's ability to build and sustain a competitive advantage utilizing traditional management concepts as well as new sustainability practices. Topics include: The Natural Step, the "Base of the Pyramid" strategy, the "servicizing" concept, and biomimicry; and various case studies showing how an enterprise can meet the "triple bottom line" while guest speakers present real world examples. Prerequisite: Capstone course requires enrollment in the last semester of program or approval of program director.
(3-0-3)

EM 597
Independent Study
This full semester or half-semester course allows a student to conduct research on a project proposed by the student, an outside organization or by the supervising professor. The student is required to submit a proposal that includes the research plan and expected outcomes. Regular meetings with the professor are required as well as a final report at the end of the eight- or 16-week period, depending on the scope of the project.
(1.5 or 3 hours)

MSF 501
Mathematics with Financial Applications
This course provides a systematic exposition of the primary mathematical methods used in financial economics. Mathematical concepts and methods include logarithmic and exponential functions, algebra, mean-variance analysis, summations, matrix algebra, differential and integral calculus, and optimization. The course will include a variety of financial applications including compound interest, present and future value, term structure of interest rates, asset pricing, expected return, risk and measures of risk aversion, capital asset pricing model (CAPM), portfolio optimization, expected utility, and consumption capital asset pricing (CCAPM).

MSF 502
Statistical Analysis in Financial Markets
This course presents the major conclusions of the econometric techniques used in finance. Ordinary least squares, maximum likelihood, generalized method of moments, and simulation methods are covered. These tools are presented through computer simulation of the various models, followed by detailed analysis of the distributions of estimators. Hypothesis testing is covered in detail. Particular attention is placed on the properties of various estimators when model assumptions do not hold. For students who qualify, a final project applying econometrics to a financial modeling problem may be chosen. Students not familiar with matrix algebra and elementary statistics should plan to make up the deficit early in the course. Additional lectures will be provided for these students.

MSF 503
Financial Modeling
This course presents the major conclusions of the econometric techniques used in finance. Ordinary least squares, maximum likelihood, generalized method of moments, and simulation methods are covered. These tools are presented through computer simulation of the various models, followed by detailed analysis of the distributions of estimators. Hypothesis testing is covered in detail. Particular attention is placed on the properties of various estimators when model assumptions do not hold. For students who qualify, a final project applying econometrics to a financial modeling problem may be chosen. Students not familiar with matrix algebra and elementary statistics should plan to make up the deficit early in the course. Additional lectures will be provided for these students.

MSF 504
Valuaion and Portfolio Management
The course is a survey of asset pricing theory. The fundamentals of bond and option pricing are covered as well as the CAPM, APT and the Fama-French models. Excel spreadsheet modeling is used to illustrate and understand the concepts of Markowitz's Mean Variance Optimization, equity valuation, option pricing, and utility theory. The courses place a special emphasis on the relationship between macroeconomic conditions and investment opportunities.

MSF 505
Futures, Opions, and OTC Derivatives
This course provides the foundation for understanding the price and risk management of derivative securities. The course starts with simple derivatives, e.g., forwards and futures, and develops the concept of arbitrage-free pricing and hedging. Based upon the work of Black, Scholes, and Merton, the course extends their pricing model through the use of lattices, Monte Carlo simulation methods, and more advanced strategies. Mathematical tools in stochastic processes are gradually introduced throughout the course. Particular emphasis is given to the pricing of interest rate derivatives, e.g., FRAs, swaps, bond options, caps, collars, and floors.

MSF 506
Financial Statement Analysis
After reviewing the content of the major financial statements, the course examines ratios, inventories, long-lived assets, income taxes, debt, leases, and pensions, among other topics. U.S. practices are compared to practices in other major countries. This course is intended for those who will examine financial statements of outside organizations.
(3-0-3)

MSF 524
Models for Derivatives
The practice of financial engineering requires skill in financial theory and practice, mathematics and programming. This course includes instruction in all of these areas. In this class, students will learn mathematical and computational methods that are applicable to the pricing and risk management of derivatives. The class provides an introduction to option pricing theory, covering stochastic calculus, the Black-Scholes partial differential equation, risk-neutral valuation and hedging and portfolio replication. The course will focus on important numerical techniques used in finance, including variance reduction techniques in Monte Carlo Simulation and finite difference methods applied to partial differential equations. These methods will be applied to the pricing of exotic options. In this class, students will learn to program and implement financial models in Matlab. Prerequisites: MSF 503 required, MSF 505 recommended.
(3-0-3)

MSF 525
Term Structure Modeling and Interest Rates
Upon completion of this course, students should know the strengths, weaknesses, appropriate uses and ways of implementing the major term structure models that are in common use. The course will begin with bootstrapping of forward curves, principal component analysis and a review of basic fixed income derivatives (swaps, swaptions, caps and floors). We will then implement short rate models, such as Ho-Lee, Black-Derman and Toy, and Extended Vasicek/Hull-White, followed by the Heath-Jarrow-Morton model and market rate models. Students will implement these term-structure models in Excel/VBA and Matlab. Prerequisites: MSF 524.

MSF 534
Corporate Finance
This course is an advanced introduction to modern corporate finance. Topics include cash flow forecasting, optimal dividend policies, mergers and acquisitions, structured finance, capital at risk, and the risk of adjusted return on capital. The philosophical foundation of the course is the concept of shareholder value added. Students will learn how financial decisions can contribute to the value of a modern corporation. Prerequisite: MSF 506.

MSF 535
Investment Banking
This course covers the financing and formation process of private companies from product concept and angel investors to the Initial Public Offering. Exit strategies for private investments are discussed, including IPOs, mergers and acquisitions. Strategic and financial buyers play a key role in the valuation of a newly public or recently acquired firm. All of the players are discussed, including venture capitalists, entrepreneurs, investment bankers, attorneys, public shareholders, merger partners, institutional investors and private equity/buyout firms. Students will discuss business models; construct staffing and compensation schemes; practice valuation analysis; compare and contrast alternative financial sources; structure business plans; review the types of securities to offer; examine private placement processes; analyze negotiation strategies; and review the implications of financing terms and the role of venture capital and private equity investment in institutional portfolios. The challenges of completing mergers and integrating merged companies are also discussed. Sarbanes-Oxley, antitrust requirements and other regulatory issues will be presented. Prerequisite: MSF 506.

MSF 543
Computational Finance
Because of the widespread adoption of computer trading platforms, the computational efficiency of financial models has become an issue of increasing concern. This course concentrates on numerical techniques for pricing derivatives found in modern markets. It includes an extensive treatment of numerical solutions of the Black-Scholes equation, using techniques such as efficient binomial/trinomial trees, finite-difference solutions of partial differential equations and Fast Fourier transforms. We will cover optimization theory as used in model calibration. We will apply these methods to various pricing models, such as stochastic volatility models and models used to price credit derivatives. Model implementation will be in Matlab.

MSF 545
Structured Fixed Income Portfolios
This course will cover the characteristics, valuation and risk management of fixed income instruments. These instruments include bonds, repos, interest rate derivatives, inflation indexed securities, mortgage-backed and asset-backed securities, CDOs and default swaps. The focus will be on understanding how these instruments are structured and used. Term structure modeling and hedging techniques will be presented, with a minimum of mathematics.

MSF 546
Quantitative Investment Strategies
This course develops the primary quantitative tools used in the portfolio selection process. The applied focus of the course centers on the process of moving from a data set of historical information to the formulation of a forecasting model, the estimation of mean-variance efficient portfolios, and the testing of efficiency hypotheses within an in-sample and post-sample setting. The course covers the estimation of efficient portfolios, factor models, forecasting models, and risk analysis. Prerequisite: MSF 414.

MSF 554
Market Risk Management
This course introduces the importance of financial risk management by developing practical risk measurement tools. The risk measurement aspect of the course begins with the development of the Value-at-Risk (VaR) methodology for financial instruments traded in open markets including equities, bonds, foreign currencies and their derivatives. The course develops analytic VaR models for instruments with non-linear payoffs and non-normal distributions and it also develops simulation methodologies for risk analysis. Statistical tools in volatility forecasting, tail events, and expected shortfall are introduced as appropriate. The emphasis of the course is on market risk, but in addition to the traditional analysis of trading rooms, the course also considers regulatory and compliance risk, corporate risk and risk analysis for investment managers. Prerequisite: MSF 505.

MSF 555
Credit Risk Management
The extensive use of leverage by individuals, corporations, hedge funds and private equity managers has led to a significant increase in the demand for models that analyze credit risk exposures. For many users, the credit risk function has evolved from models used to analyze the quality of an individual borrower to models that aggregate exposure across borrowers, industries and geographic regions. This course provides an extended overview of the exciting and rapidly developing field of credit risk analysis. Prerequisite: MSF 505.

MSF 556
Enterprise Risk Management
This course follows up on MSF 581 (Market Risk Management). It focuses on the other two main silos of risk in the financial industry, namely, credit risk and operational risk. The course will also discuss asset and liability management, interest risk management, integration of credit risk and market risk, regulatory and compliance issues, and performance measurement and capital management. The quantitative aspects of the course include: volatility and correlation modeling, Monte Carlo simulation, stresstesting and scenarios analysis, extreme and tail events modeling. Prerequisite: MSF 505.

MSF 564
Financial Theory
This course covers the foundations of financial economics and the theoretical underpinnings of contemporary asset pricing models. We will explore the many uses and extensions of the fundamental pricing equation: where Pt is the current price, is the pricing kernel or stochastic discount factor, and is a future random payoff. The "art" of asset pricing is in how one specifies the functional form of the pricing kernel. With different assumptions yields the Capital Asset Pricing Model, the Consumption-CAPM, the Black-Scholes-Merton option-pricing model, and many popular term structure models. The Consumption -CAPM does not fare well in the empirical literature motivating the study a promising group of nextgeneration risk/return models. The latter part of the course will be devoted to continuous-time asset pricing of options and the modeling of the term structure. The emphasis will be on risk-neutral, Martingale pricing methods, rather than solving partial differential equations. This material is a theoretical complement to the Computational Finance and Financial Modeling sequences. Prerequisite: MSF 501.

MSF 565
International Finance Theory
This course will focus on the determination of prices, interest rates and exchange rates within the context of neo-classical equilibrium models. The theoretical foundations of the course will be supplemented by extensive exercises in econometric testing of maintained hypotheses and exercises in real time trading. Prerequisite: MSF 501.

MSF 566
Financial Time Series Analysis
This course develops a portfolio of techniques for the analysis of financial time series. Distribution theory covers the normal, Student T, Chisquared and mixture of normals models. Technical analysis covers a variety of trading rules including filters, moving averages, channels and other systems. The first two topics are then combined into an analysis of non-linear time series models for the mean. The course concludes with a review of volatility models including GARCH, E-Garch and stochastic volatility models. Prerequisite: MSF 502.
(3-0-3)

MSF 567
Bayesian Econometrics
Most statistical applications in finance require that the forecasting models be revised in response to the arrival of new information. This course develops the Dynamic Linear Model (DLM) as an updating model based upon Bayesian decision theory. Applications of the DLM, including regressions, autoregressions, and exponential trend models will be covered. Special emphasis will be given to the development of intervention and monitoring systems and the use of simulation methodologies. Students not familiar with matrix algebra and elementary statistics should plan to make up the deficit early in the course. Prerequisite: MSF 502.

MSF 574
.NET and Database Management
The course provides students with a comprehensive knowledge of .NET (VB and C#) programming, relational database design and SQL as they apply to quant finance and real-time trading. Specifically, topics covered include the .NET framework and libraries, ADO.NET, OOP, generics, market data feeds, XML and the Unified Modeling Language, as well as an overview of the hardware and network infrastructure necessary to enable electronic trading.

MSF 575
C++ with Financial Applications
This course presents the C/C++ programming language. Students learn the language from the ground up, from data types, to functions, arrays, classes, dynamic memory management, data structures and the Standard Template Library. Object-oriented programming is also discussed, including a review of commonly used design patterns. The focus is to understand C/C++ as it applies to financial mathematics and several practical examples from computational finance are presented.

MSF 576
OOP and Algorithmic Trading Systems
In this course, students learn advanced programming topics in .NET for real-time financial applications and automated trading systems, including multithreading, sockets, APIs, synchronization, the FIX and FAST protocols, and object oriented design for event-driven applications. Also, project management and software quality are covered in depth. Lastly, topics related to latency in real-time financial applications and alternative network architectures are also discussed. Students are expected to propose, design, document and develop an original project combining concepts from quantitative finance and trading strategy (presented in other courses) into a working software application.

MSF 584
Equity and Equity Derivatives Trading
This course will provide students with an opportunity to learn the latest Equity Trading Strategies used by large banks, brokerages and hedge funds. The instructor will present strategies on equity option trading, pairs trading, program and basket trading, risk arbitrage trading, structured product trading, and dispersion trading (time permitting). Equity trading theory and practical examples will be discussed. Students will be required to structure and adapt equity trading positions based on a range of actual and theoretical market conditions. In addition, students will collaborate with each other and the course instructor to analyze and evaluate the implementation of the above-mentioned strategies. Prerequisite: MSF 504.

MSF 585
Fixed Income Options and Securities
This course will present basic trading concepts related to fixed income instruments. Also covered will be the analysis of repos and fixed income derivatives, such as f orwards and futures, options and spreads. Trading strategies will be discussed, including yield curve strategies, basis trading, and various types of spread trading using many different instrument types. Students will make trading decisions and modify their portfolios in order to familiarize themselves with the instruments and techniques introduced. Swaps, Swaptions, Caps and Floors will be introduced, time permitting. Prerequisite: MSF 504.

MSF 591
Global Financial Markets
This course will enable the student to understand the basics of financial markets and how they function in the global arena. The student will learn how the equities market, the bond market, the money market, the foreign exchange market and the derivatives markets are set up and operate. We will focus on the instruments, the players, the jargon, the details of the trade, and the institutional framework for each market. We cover both OTC and exchangetraded markets, and explore the dramatic transformation of these markets. The student will learn how each of these markets operates in the US, but will also learn how practices differ in Europe, Asia and Latin America.

MSF 593
Market Microstructure
Market microstructure is one of the youngest but most rapidly growing areas of finance. It focuses on the organization of traded markets, including those for equities, bonds, money market instruments, foreign exchange and derivatives (including futures, options and swaps). It explores the concepts of liquidity, transparency, the information content of bids, offers and trades, information asymmetries, order flow externalities, principal-agent problems, the design of markets, the rules of markets, the volatility of markets, the failure of markets, the regulation of markets and the costs of trading. Empirical work in this area typically involves huge datasets. Students will leave this course with a thorough understanding of the structure of the markets in which they will likely spend their careers. Prerequisite: MSF 501.

MBA 501
Financial & Management Accounting
An introduction to the basic financial and managerial accounting topics: GAAP, the major financial statements, accrual accounting, financial reporting alternatives, financial statement analysis, cost behavior, cost systems, short- and long-term decision-making and product costing.
(3-0-3)

MBA 503
Organizational Behavior
Builds awareness and understanding of the behavior of individuals and groups in organizations, preparing managers to be more effective within their organizational contexts. Topics include individual differences in motivation, perception, culture and learning style; group and organizational dynamics; and the impact of organizational structure and culture on behavior. Leadership techniques for influencing other organizational members, creative problem-solving and decision-making, ethics and values- based managing are covered. This course helps students relate basic theories, concepts, and techniques to real-world situations through the extensive use of case studies.
(3-0-3)

MBA 505
Managerial Economics
The behavior of firms and households and the determination of prices and resource allocation in a market economy. Topics include empirical demand, production and cost functions, monopoly, oligopoly, and pricing practices.
(3-0-3)

MBA 507
Managerial Decision Making
The course introduces the business research process and teaches analytical statistical methods that can be used for managerial decision-making. It also covers managerial decisionmaking under uncertainty. Topics include probability, sampling, estimation, hypothesis testing, linear regression, and goodness-of-fit tests.
(3-0-3)

MBA 509
Managerial Finance
An introduction to the basic concepts and practices used by managers in making financial decisions. Topics include cash flow analysis, capital budgeting, short- and long-term financial planning, cost of capital, financial leverage, and dividend policy.
(3-0-3)

MBA 511
Marketing Management
This is an introductory course in marketing designed for graduate students. It takes the "customer value" perspective and defines marketing as a business process that chooses value, creates value, communicates value and delivers value. This course helps you understand intricacies involved in the value creation and delivery process in a 21st century firm that competes for customers in a highly competitive global marketplace. In terms of teaching pedagogy, the course employs a theoretically rigorous, yet practically relevant, approach. There will be interactive lectures and analyses of real-life marketing decisions. The course will also feature an exciting computer simulation project which gives students an opportunity to "get their hands dirty", and allows them to learn not only the development of marketing strategy, but the implementation and execution of such strategy.
(3-0-3)

MBA 513
Operations Management
The course focuses on decisions to be made by operating managers in managing the technology, capital, and human resources of organizations in the process of producing goods and services. Topics include: equipment, technology, and process selection; product/process integration and innovation and the basic tools required for process design; work force, materials, and quality management; and aggregate planning and scheduling.
(3-0-3)

MBA 515
Strategic Information Systems
The effective planning and deployment of information technology [IT] will enable your organization to compete aggressively, rapidly, and globally in this digital age. A critical ingredient of success is the alignment of expectations by senior executives and IT management for leveraging IT investments to create business value. We will analyze the key decisions involved in the planning, operations, and control of IT. Additional emphases will be devoted to e-business integration, knowledge management, and emerging information technologies. Cases and PC exercises will provide practical applications of IT. Tools include business process analysis, IT portfolio management, online analytical processing, and data mining.
(3-0-3)

MBA 517
Strategic Competitiveness
The student will gain an understanding of the concept of Strategic Competitiveness (SC), with a command over powerful concepts including strategic positioning, industry clusters, the economic diamond, the corporate value chain, and the global supply chain. The student will apply the appropriate SC concepts through analysis of "real-world" situations. The goal is to equip students to be able to articulate economic strategies in a compelling way to private and public leaders. The student will understand the important dynamic operations among the various societal sectors and the concept of economic development in urban environments within a global economy. The student will apply "cutting-edge" business and social science methods by means of case studies, class discussions, and project requirements. The course offers students a strategy and leadership laboratory, with peer and external interactions essential for success in today's fast-changing business environment.
(3-0-3)

MBA 525
Strategic and Functional Management
This is a two-part capstone course for all MBA students. In the first part of the course, through the CAPSIM simulation project, students will learn how to implement business strategy and tactics. Emphasis is on how the various business functions could be integrated for the purpose of creating superior customer value. In the second part of the course, students will learn an integrative approach to the role of the general manager and the tasks of creating an effective business unit: crafting strategy; designing and maintaining an organization for implementing strategy; leadership and change management; and corporate governance. The course is designed around a model of the "fit" between industry structure-business strategy, organization design, and financial, operational and behavioral outcomes-and the complex task of maintaining that "fit" over time. Special attention is paid to drivers of change and sources of complexity, such as size, market diversity, and rate of growth. Case studies are used to develop total organization perspectives, to focus on individual leadership and management skills, and to emphasize the linkages between theory and practice. As the capstone course of the MBA program, this course must be taken during the final semester. Prerequisite: To be taken in last semester; or advisor approval.
(3-0-3)

MBA 552
Strategically Managing Cost and Investment Decisions
This course builds on the financial and management accounting foundation presented in MBA 501. Competitive strategy is linked with management decisions concerning the understanding of costs and investment decisions. Managerial topics, i.e., activity based costing, the theory of constraints, strategic decision making, management and operational control, cost estimation, budgeting and cost allocation, will be covered so that the student willdevelop a betterunderstanding of the underlying costs. There will be discussion of "green accounting" techniques as well. Investment decisions are based on understanding the financial statements of potential equity investments. Ratioanalysis is covered as an evaluation tool, and detailed coverage of significant financial accounts; inventory, fixed assets, debt, leases, pensions, and others, will address the necessary manipulations that will place the underlying accounting methodology on a comparable basis. These equity investment decisions will also be discussedin relation to the organizations competitive strategy. Pre-requisite: MBA 501 Financial and Managerial Accounting, or equivalent
(3-0-3)

MBA 553
Data Mining
The digital enterprise captures significantly more data about customers, suppliers, and partners. The challenge, however, is to transform this vast data repository into actionable business intelligence. Data mining and predictive analytics can provide valuable business insights. A leading data mining tool, e.g., IBM/SPSS Modeler will be used to investigate hypotheses and discover patterns in enterprise data repositories. Both data cleaning and analyses will be discussed and applied to sample data. Analysis tools include decision trees, neural networks, market basket analysis and discriminant analysis. More recent approaches, e.g., geographical, text and web data mining will be addressed. Applications of data mining in a variety of industries will be discussed. Software exercises, case studies and a major project will prepare you to use these tools effectively during your career. Prerequisite: MBA 507 or instructor consent.
(3-0-3)

MBA 554
Project Management
This course addresses both analytical and behavioral skills for effective project management. You will learn how to select a project portfolio, develop a work breakdown structure, estimate task times and costs, allocate and level resources, prepare Critical Path and PERT analyses, and assess earned value project performance. A leading project management tool, e.g., MS Project will be used for project management exercises. Much of the course content will be drawn from the Project Management Institute Common Body of Knowledge and Certification Program. Management of project risks, structure, team building and conflict will be addressed. A Project Management simulation game provides an opportunity to apply your team-based skills. A variety of project management cases across industries will be studied.
(3-0-3)

MBA 555
Contemporary Issues in International Business
To operate in the complex environment of a globalized world, managers must develop an in-depth understanding of current events. The international business professional must develop an appreciation for topics such as the OPEC oil cartel, international risk analysis, technological advances as a driver of global markets, major international strategies, cross-cultural competence, the political economy of modernization, collaborative ventures, and international acquisitions. The course also provides rigorous economic analysis of the modern theory of trade as well as government trade policies. It deals with the factors that determine the exchange rates under the floating and fixed exchange rate systems. Furthermore, the course analyzes the crises in emerging markets and the need to revamp the international financial system. In the area of trade, topics covered include: the Doha round, economic integration (i.e. the EU, free trade areas), and the meteoric rise of sovereign wealth funds (SWF).
(3-0-3)

MBA 556
Operating System and Supply Chain Management
We will present models and practices to optimize the management of both demand and supply for a company's products or services, with an emphasis on the integration of business and technology aspects. This course will first introduce an integrated view of the production and logistics functions in organizations such as capacity analysis, inventory management and logistics management. The course then discusses topics involved in the interaction of a firm with other players in a supply chain such as value of information, supply contracts, price-based RM and quantity-based RM. Prerequisites: MBA 507 and MBA 513.
(3-0-3)

MBA 557
Contemporary Business Law
This course will introduce graduate business students to legal issues that are pertinent to working in the modern American business environment. It will cover legal issues pertaining to business organizations (e.g., essentials of forming a partnership or corporation and corporate governance); ethics; transactions (e.g., basics of the Uniform Commercial Code, anti-trust issues in pricing and market share; representations to customers, contract formation, performance, contract disputes); personnel (e.g., hiring practices, anti-discriminations laws, including those that address age, gender, etc., and accommodations under the Americans with Disabilities Act); international business (e.g., U.S. boycott and anti-boycotts laws; U.S. Foreign Corrupt Practices Act; Contract for the International Sale of Goods); and e-commerce.
(3-0-3)

MBA 558
Global Expansion Strategy
Global expansion represents an attractive growth strategy for many companies. In particular, China, India, Brazil and other emerging countries represent very good opportunities for growth. However, there are significant risks as well in global expansion. Firms could take advantage of opportunities while simultaneously reducing risks if they develop a systematic strategy to enter foreign markets and expand in them. This course teaches students how firms could develop and implement comprehensive strategies to achieve their global growth objectives. Topics covered include: Alternative growth strategies, the global expansion option, assessment of opportunities abroad, selection of markets, foreign-market entry modes, market development strategies, regional and global coordination. Prerequisite: MBA 511; or instructor consent.
(3-0-3)

MBA 561
Models for Decision Making
Models for decision analysis in various functional fields including finance, marketing, and operations. Applications include media selection, capital budgeting, portfolio selection, advertising effectiveness, plant location, distribution planning, and production planning. The focus of the course is building models and using software to aid in decision-making. Prerequisite MBA 507.
(3-0-3)

MBA 562
Spreadheet Modeling
Spreadsheets are a popular modelbuilding environment for managers. Add-ins and enhancements to Excel have made powerful decision-making tools available to the manager. This course covers how to use the spreadsheet to develop and utilize some of these decision-making aids. Visual Basic for Excel allows the nonprogrammer to create modules for functions, subroutines, and procedures. Topics include forecasting (both regression and time series), decision-making under uncertainty and decision trees, using SOLVER for optimization, and probabilistic simulation using @RISK. Prerequisite MBA 507.
(3-0-3)

MBA 565
Advanced Data Analysis
An examination of the methods for analyzing data. Topics include analysis of variance, multiple regression, nonparametric methods, Bayesian and decision analysis. Sampling methods and multivariate analysis, including the bivariate normal, confidence interval and hypothesis tests of the centroid, discriminant analysis, conjoint analysis and factor analysis. Prerequisite MBA 507
(3-0-3)

MBA 575
Creativity and Contemporary Entrepreneurial Opportunities
Entrepreneurship focuses on the concepts, skills, and know-how, information, attitudes and alternatives that are relevant for start-up and early-stage entrepreneurs, entrepreneurial managers and the relevant stakeholders. Specifically, this course provides an introductory overview of the knowledge and skills needed for the identification, evaluation, and exploitation of opportunities in a variety of circumstances and environments. It concentrates on the study of various innovative thinking in strategy, identifying and screening a business opportunity, developing business models, preparing business plans, securing financing and managing high growth firms. It integrates knowledge gained from the prior core business courses (i.e., management, marketing, finance, accounting) to sharpen the student's ability to "think strategy innovatively and think entrepreneurially" and form new ventures. Further, it is a course that mixes theory with practices covering industries such as computer, cell phone, biotech, wireless, to name just a few. You will be challenged to apply principles, concepts and frameworks to real world situations, culminating in a formal business plan. Prerequisites: MBA 509, MBA 511; or instructor consent.
(3-0-3)

MBA 576
Creating and Financing New Ventures
The course concentrates on the study of entrepreneurship, preparation of business plans, methods for evaluating and screening new venture ideas, formulation and implementation of business strategies for new ventures, development of a business plan, the financing of new ventures and venture growth strategies and exits. It integrates knowledge gained from the prior core business courses (i.e., management, marketing, finance, accounting) to sharpen the student's ability to "think entrepreneurially" and form new ventures. The course will also focus on identifying, examining and evaluating various sources of original and growth capital. Emphasis will be on legal, financial and tax issues related to capital formation as well as specific problems experienced by the small-to-medium-sized firm undergoing rapid growth. Topics discussed will include venture valuation, financing startups, financial planning and strategy, going public, selling out and bankruptcy. A formal proposal for capital acquisition developed through field research will be required of each student. Prerequisites: MBA 509, MBA 511; or instructor consent.
(3-0-3)

MBA 581
Marketing Research
An overview of the marketing research process, the course focuses on basic principles that permit the decision-maker to understand and make better use of research results. Topics covered include problem identification, research and data instrument design, and sampling. Methods for estimating short- and long-term market potential for new and existing products will also be discussed. Prerequisites: MBA 511.
(1.5-0-1.5)

MC 503
Strategic Brand Management: Creating Brand Ownership (elective)
The most valuable assets that a company has are the brands that it has developed and invested in over time. Students will explore the components of a brand, its equity and emotional benefits and an understanding of how to develop a meaningful "brand relationship" with the customer or prospect to optimize the brand or brand portfolio. The class will also explore the various aspects required to champion a new product or service from development to launch by optimizing the execution through all the marketing efforts of the firm. Students will address positioning, channel strategies, trade promotion, budgeting as a part of the planning process, new product development, packaging and merchandising and the management of agency relationships. Like people, brands have unique personalities that differentiate them and drive their ability to grow or limit their ability to expand.
(3-0-3)

MC 510
Marketing Foundations: The Art of Marketing (core)
This course provides students with a holistic examination of the theory and practice of marketing. Learning will concentrate on how marketing can transform how companies look at customers and how innovation and creativity can enhance competitive performance. Topics include: how to interpret overall company business plans; how products/services are designed, created, tested, produced, priced, positioned and distributed; market segmentation and product life cycles; the economic foundations of marketing; and sales and cost-benefit analyses. Marketing models from contemporary thought-leaders and case studies are employed.
(3-0-3)

MC 514
The Marketing Communication Plan: Developing Transformative Marketing Strategies (core)
In this course, students learn how to identify and evaluate the full gamut of competitive strategic alternatives in both business to business and business to consumer marketing using a wide variety of analytic tools to develop and analyze consumer insights. Based on this analysis, the major elements of a communication plan are put in place: media, message, target audiences, testable objectives, and budgets. Students learn to measure consumer and business target audiences by their demographic, psychographic and attitudinal characteristics and to analyze the style and appeal of messages within campaigns. Students also learn how to develop a balanced marketing communication plan utilizing the multitude of vehicles available to reach a target audience using the latest technological tools and media.
(3-0-3)

MC 516
Marketing and Advertising Research: Building Consumer Insight Through Research (core)
This course is an introduction to the purposes and methods of research. The course is a state-of-the-art hands-on course that concentrates on how research provides critical information for marketing and communication decisions. Topics include identification of the research problem, research design, data-gathering techniques, sampling procedures, data analysis, and report preparation. The course exposes the student to basic statistical methods using both qualitative and quantitative research methodology.
(3-0-3)

MC 520
Understanding the Target Audience (core)
Understanding the demographics and psychographics of target audiences is essential to an effective marketing communication strategy. From data to information to insightful strategic marketing, this course covers what's important to know to make more effective marketing decisions. Social, cultural, psychological and attitudinal factors are explored with particular attention to motivation, how attitudes are shaped and altered, how information is processed, and the role of learning in the formation of purchasing decisions. Theories and models of consumer behavior are examined to develop incisive insights into consumer behavior that can build strong brands.
(3-0-3)

MC 522
Media Strategy and Implementation for the 21st Century (core)
This course focuses the massive transformations based on new technologies that are occurring in today's communication environment, and the wide variety of consumer contact points it generates. Students will develop an understanding of how the industry is organized and how marketing communications flow from the source company to the target audience. The course examines the major aspects of developing and evaluating media plans, beginning with the development of media strategies that flow from overall marketing communication goals. The course analyzes various media from the perspectives of cost, targeting, audience characteristics, and the nature of product/service. The course also includes examinations of information sources, such as Arbitron, Nielsen, and Simmons, and software, such as Manas, IMS, Telmar, Adware, and Tapscan.
(3-0-3)

MC 524
Creative Strategies (core)
This course deals with translating business and marketing strategies into creative executions that deliver effective messages to the intended target audience. The course focuses on the analysis of consumer information for meaningful insights, and translating those insights into incisive strategies for execution in print, TV, radio, direct mail, Internet, and other delivery vehicles to consumer and business audiences. Based on the development of creative goals and strategies, the major elements of advertising are studied: the central idea to be communicated (unique selling proposition, positioning, brand personality, or campaign theme), the appeal of the creative concept (informational, news, emotional), and the style or approach of the creative message (slice of life, testimonial, corporate image, celebrity presenter). The creative process of "brainstorming" is used to hone creative thinking skills to see beyond existing paradigms to develop innovative executions capable of transforming consumer attitudes and beliefs.
(3-0-3)

MC 533
Database and Direct Marketing
This course introduces the students to the critical nature of information gathered in real-time directly from important constituencies or third party sources. It explores the ability of data based marketing to match consumers with products based on behaviors. Students learn to access and analyze database information, as well as develop programs to illicit a direct and immediate response using a variety of direct to consumer/direct to business tools including electronic marketing.
(3-0-3)

MC 535
Sales Promotion and Alternative Media Techniques
This course provides an overview of the more specialized applications and techniques of alternative media channels including public relations, event marketing, social media, free media and sales promotion, and how they fit into an overall marketing communication plan. Special emphasis is given to an overview of strategically sound merchandising and sales promotion programs, and how they can enhance the other communication efforts of the company or brand.
(3-0-3)

MC 536
Practicum (core)
This capstone course is designed to integrate all the skills learned in the Marketing Communication program in a practical context. Student teams will compete as mini agencies with an assignment from a major Chicagoarea marketer. Briefed in detail by their client, they will develop a marketing strategy and a complete, detailed marketing communication plan. Based on secondary research and original research conducted by the teams, the marketing communication plan will include a media plan, a creative program, budget recommendations, and recommendations for the use of public relations, database marketing, promotion, online marketing, event marketing, as well as other media vehicles. Teams will make formal presentations of their plans to client senior management.
(3-0-3)

MC 546
Communication Strategies ifor Emerging Technologies
Advertising on the Internet is governed by an entirely different set of parameters. This course explores the different skill sets involved in promoting in the on-line environment, from search engine optimization, banner ads, to permission e-mail marketing, with its own rather intricate set of rules. With more money invested in search engine marketing than network television, companies are finding that the Web is among the most important media vehicles in the marketing arsenal. For the marketing communication professional, these new digital tools and tactics will be essential for success.
(3-0-3)

MC 554
Customer Relations Management (concentration)
In a world where it costs five times as much to acquire a new customer as it does to keep an existing relationship, companies are learning that they must manage those current customer relationships in order to survive. Around this insight, a new discipline has emerged, using some of the tools of database management and some of the new tactics of digital communication to reduce attrition, and maximize the lifetime value of a customer. Customer Relationship Management (CRM) is making fundamental changes in the way companies operate. It is a critical point of merger, where e-business becomes a part of all business. This course will engage the student in the diagnosis of CRM issues, the building of CRM plans, the measurement of their effectiveness, and the new tools available to get all these things done economically, in Internet time.
(3-0-3)

MC 555
Marketing Analytics
With the proliferation of data has come new and exciting ways to manipulate that data to significantly enhance our marketing efforts. More and more, analytics is being applied to seek answers to marketing and advertising issues. Marketing Analytics can be used to optimize strategies, commercial messages, as well as visual content of that message. Students will use proprietary software in simulated class exercises to seek optimal strategies and messages for class projects.
(3-0-3)

MC 563
Web Page Design (elective)
The content, organization, presentation, and functionality of Web sites are critical to attracting and retaining customers or members of an audience. Subtle issues of design and organization can have profound consequences on a site's ability to persuade, communicate, compete, and close a transaction. Principles of effective site design will be used to evaluate existing sites. An authoring tool, e.g., Dreamweaver or Frontpage will be used to build a Web site.
(3-0-3)

MSC 530
Probability & Statistics
The students will learn the fundamentals of probability and how to use this tool to solve common problems in industry. The course material includes a large variety of topics in business, engineering and management science. The topics include the fundaments of probability, random variables, transformations, discrete, continuous and joint distributions, normal, lognormal, bivariate and sampling distributions, parameter estimating methods, confidence intervals, hypothesis testing, and regression.
(3-0-3)

MSC 534
Queueing Theory
The students will learn how to solve many of the queuing problems that are found in common industry situations. The course will show how to formulate and solve the more complex queuing problems and the methods in probability that are used in formulating the queuing models. The fundamentals of matrix systems, priority systems, Erlang systems, simulated queues, stochastic processes and markoff chains are described. Prerequisite: MSC 530.

MSC 538
Simulation and Data Analysis
The objective is to learn how to generate solutions to problems, not known otherwise how to solve. The class emphasizes how a simulation project is formulated from computer programming. The student learns how to generate random responses for continuous, discrete, poison process and multivariate distributions. Methods to determine the probability distribution to use and the techniques to estimate the parameter values are shown along with examples. Ways to analyze the output results from transient, steady state and fixed event models are shown. The use of response surfaces, single-factor, multi-factor, fractional, and non-linear design of experiments, non-parametric methods and min and max distributions are given. Prerequisite: MSC 530.
(3-0-3)

MSC 543
Time Series
The course gives a cross section on the methods of forecasting with emphasis on production and inventory. For each method, a description is given on the mathematical basis, the calculations to carryout and an example problem. The student becomes aware of the powerful tool of forecasting and how they apply in a wide range of business and industrial problems. The course covers filtering, horizontal, trend, seasonal, multi-location, smoothing, discounting, adaptive control, adaptive smoothing, trigonometric and Box- Jenkins forecast models and forecast errors. Also how the forecast are used in decision making in production and inventory operations. Prerequisite: MSC 530.
(3-0-3)

MSC 550
Topics in Quality Management
The understanding, development and implementation of total quality management approaches with a focus on customer satisfaction and economics of quality. Concepts and tools of quality design, quality of conformance and quality of performance will be discussed. Theoretical and empirical research will be the basis of this course. Prerequisite: MSC 530.
(3-0-3)

MSC 560
Optimization Techniques I
Optimization techniques, with the primary emphasis on linear programming, and application interspersed to illustrate the applicability of the optimization techniques. The majority of the course will be linear programming techniques, including the simplex-method and its variants, interior point algorithms, and duality and sensitivity analysis. The other part of the course discusses model formulation with integer variables and develops the theory of computational methods of integer linear programming: cutting plane, branchand- bound, and Lagrangian relaxation methods.
(3-0-3)

MSC 562
Optimization Techniques II
The theory and computational methods of nonlinear programming is the majority of the course, including convex analysis and unconstrained methods, Kuhn-Tucker theory, saddle points and duality. Algorithms discussed include one for quadratic programming, linearly constrained, nonlinearly constrained, penalty and barrier methods. Prerequisite: MSC 560.
(3-0-3)

MSC 564
Optimization Techniques II
The course covers Dynamic programming formulation of deterministic decision process problems, analytical and computational methods of solution, application to problems of equipment replacement, resource allocation, scheduling, search and routing. Introduction to decision making under risk and uncertainty. Prerequisite: MSC 560.
(3-0-3)

MSC 568
Supply Chain Methods
The course gives a cross section on the production, distribution and retail stages along the supply chain. Emphasis is presented on the inventory needs at the various stages and the methods that are used in their control. A quantitative description on the tools and methods used are presented along with examples. The student becomes aware of the needs and techniques at the various stages across the supply chain. The course gives the fundamentals on forecasting, order quantity, safety stock, replenishment, stock-keeping units, production, reusable inventory, assembly, logistics, multiple locations, low demand items, initial order quantity, all time requirements, late delivery and lost sales. Prerequisite: MSC 530, MSC 538.
(3-0-3)

MSC 574
Scheduling Theory
This course introduces students to theory, cases and current research in classic and new scheduling approaches. In addition to continuous scheduling systems found in the manufacturing sector and in the service sector, finite life project scheduling topics are also covered. New evolutionary optimization solution approaches such as Genetic Programming, Tabu Search and Simulated Annealing are explained in detail. Complexity theory, as applied to the modeling and the solution of large scale optimization problems, is also covered. Student initiated scheduling scenarios that may lead to further research or dissertation topics are encouraged and solved with the help of the professor. Prerequisite: MSC 564.
(3-0-3)

MSC 576
Practicum in Teaching and Curriculum Skills
This course enables PhD students to address overall issues of pedagogy, as well as the development of personal classroom skills. The course covers curriculum development, sources of classroom materials and use of various teaching methods.
(1-0-1)

MSC 595
Operations Management Seminar
This course focuses on the intersection of Economics and Operations Management. In particular, we examine the influence of microeconomic theory, particularly game theory, on analytical OM research. Topics covered will include incentives, information sharing, competition and coordination in inventory and supply chain management. The course material will revolve around classic and recent publications in well-known journals. The course is a discussion-based course. Prerequisite: Advanced standing and instructor's consent.
(3-0-3)

PA 501
Introduction to Public Administration
Analyzes what public managers actually do in relation to elected officials, agency personnel, client groups, the press and the public, including attention to the value conflicts they confront and must resolve. Considers both classical and contemporary views and emerging issues. Introduces the student to the systematic analysis of government operations.
(3-0-3)

PA 502
Complex Organizations
Analyzes how large public and nonprofit administrative agencies are organized, led and managed. Examines relationships between the chief executive, line management operations and support staff. Considers relations between the organization and its environment, the importance of interorganizational networks, and the role of power in organizational life.
(3-0-3)

PA 503
Administration Law
Considers the role of statutes, case law and administrative law in the establishment, operation and control of public agencies. Examines how legislation and administrative procedures direct and constrain the exercise of discretion by public managers and how they ensure accountability and the fair treatment of the public. Prerequisite: PA 501.
(3-0-3)

PA 505
The Law and the Nonprofit Sector
Examines local, state, and Federal law as it pertains to the nonprofit sector. This includes such things as the IRS, lobbying, human resources, property, and contracts.
(3-0-3)

PA 508
Seminar in Public Management
Students attend lectures and make site visits to state and local agencies and governments, learning about special problems encountered by leadership for each agency and the solutions that the agencies have devised. This course offers students an opportunity to interact with a group of agency directors, public officials and staff about their experience and solutions to common management problems. Students compare experience of local leaders with theoretical public administration material. Prerequisites: PA 501 and permission of Program Director.
(3-0-3)

PA 509
Practicum in Policy Analysis
A student project course that concludes the required core course sequence. Focuses on the analysis of a complex, real-world administrative or policy problem. Requires analyses of legal, financial, personnel, organizational and political aspects of this problem, followed by the preparation of a thorough written and oral report, including recommendations for action. Prerequisite: All other core courses.
(3-0-3)

PA 510
Managerial Communications
Provides hands-on training and practice in the effective styles of writing and related communications skills needed by all public managers, including memoranda, letters and formal reports. Emphasis is placed on learning and practicing effective writing and communication related to real-world administrative and managerial situations relevant to the student's particular current or chosen professional position.
(3-0-3)

PA 511
Comparative Public Administration
An introduction to comparative analysis of systems of public administration in selected nations, including Great Britain, Japan, China, and major non-governmental organizations such as the European Union and the United Nations. The nations and organizations discussed will be compared to each other and to the United States. Areas explored will include: the historical antecedents of current national administrative systems (including the development of the nation-state), public administration models and structure in both developed and developing nations, the relationship between bureaucracies and political systems, the rise of the international nongovernmental organization, and the impact of corruption on public administration.
(3-0-3)

PA 512
Public Advocacy
The goal of this course is to assist students function as strong advocates in their future careers and to help them prepare for their thesis or final presentation. This is an advanced research and writing course. Public Advocacy is the study of effective argument. The course is designed to allow students to focus their prior learning experiences through problem analysis and advocacy. Using individual topics, students will address the problems of advocacy: different types of advocacy situations, requiring different information, analyses and presentations. Substantive topics of current interest and controversy will be discussed in the context of developing and advocating a particular position.
(3-0-3)

PA 513
Public Policy Analysis and Evaluation
Explores techniques of policy analysis and program evaluation having practical application in such fields as transportation, education, housing, criminal justice and environmental quality. Includes those research and analytical methods most frequently applied in governmental decisionmaking. Prerequisite: PA 501.
(3-0-3)

PA 514
Government Management and Information Systems
A practical introduction to database management programs. Demonstrates the use of a variety of other office automation software tools (including graphics, desktop publishing, telecommunications/file transfer, bibliographic text retrieval, computer-aided instruction, and expert systems). Considers issues relating to effective computer management, including computer ethics, security, needs assessment and training. Prior working knowledge of personal computer operating systems, word processing, and spreadsheet programs is needed. Prerequisite: PA 501.
(3-0-3)

PA 516
Information Technology in Public Administration
The course has the learning objective of becoming aware of the general management challenges that the use of information technology presents for governments and to be able to develop appropriate policies that address these challenges. Upon completion, students should be able to apply best practices to the management of computer hardware, software, networking, and other technologies in government and appreciate how the use of "electronic government" technology can transform government and be able to help governments develop and manage effective programs of e-government use.
(3-0-3)

PA 522
Public Personnel Administration
Reviews development of meritbased civil service, examining implications of political accountability, and patronage and professional responsibility. Considers personnel recruitment, examination and promotion procedures in light of collective bargaining, affirmative action, and employee productivity and performance evaluation. Prerequisite: PA 501.
(3-0-3)

PA 531
Government Accounting and Budgeting
Focuses on the budget as policy and management control mechanism in public and nonprofit agencies. Introduces students to concepts, principles, and procedures of governmental accounting. Links budgeting to program management, accounting, financial reporting and auditing. Prerequisite: PA 532.
(3-0-3)

PA 532
Principles and Practices of Public Finance
A general review of public finance management. This course is designed to provide students with an understanding of the public finance environment and an opportunity to explore practical challenges in managing governmental resources. Includes basic accounting, analytical tools, budgeting, purchasing, and cash management. Examines the integrated role of the various finance functions. Prerequisite: PA 501.
(3-0-3)

PA 533
Advanced Financial Management for the Public and Nonprofit Sectors
An advanced course focusing on the application of techniques used by financial managers to evaluate government financial condition and performance. Students will conduct case studies in which they apply tools such as performance measurement, budget analysis, priority-setting and financial indicator analysis to evaluate core public financial documents including budgets, capital improvement plans and audited financial statements. Prerequisite: PA 532.
(3-0-3)

PA 534
Financial Management of Nonprofit Organizations
Nonprofits are businesses organized on many of the same principles as for-profits, but there are differences including financial reporting to boards of directors, donation accounting, reporting to government funding sources, tax reporting, and even investment strategies (for example program related investing). This course will equip a nonprofit manager to responsibly guide the complex financial life of a modern nonprofit. Prerequisite: PA 532.
(3-0-3)

PA 535
Resource Development in the Nonprofit Sector
Provides insight and learning into fundraising, marketing, and strategic planning in the nonprofit sector. This course offers an in-depth look into finding and securing the resources necessary to the success of nonprofit organizations.
(3-0-3)

PA 536
Strategy and Structure: Homeland Security
Students are introduced to the National Strategy for Homeland Security and the structure under which it was originally designed, the events that have affected the original concept and the various changes that it has undergone since the events on 9/11/2001. An emphasis on the overall integration of state, local, tribal and private sectors will enable the student to apply the tenets of Homeland Security to their own situations. Other topics include an understanding of how to conduct threat assessments as well as a cursory understanding of the intelligence cycle.
(3-0-3)

PA 537
Homeland Security/Crisis Management
This course is taught by experts from various disciplines and provides a basic overview of homeland security including a brief history of terrorism. Specifically, the course is intended to provide the audience issues related to homeland security, awareness on the types of threats (damage to buildings, processing plants, public facilities, etc.) and the type of risks involved. Other relevant aspects include types of weapons used by modern terrorists; how one goes about estimating risk and threat to a facility; how buildings and people respond when subjected to blast and fires; the role of search and rescue operations; weapon effects; building security; facility analysis to identify vulnerable areas given a threat; procedures for minimizing vulnerability; effective fire safety; contingency plans, etc. At the conclusion of this course the student will know how to estimate the risk and threat to a given facility, prepare a basic security audit; develop a basic contingency plan, develop a passive/ active security system for a given facility and develop post event search and rescue operations.
(3-0-3)

PA 538
Information Systems Security/Cyber Crime
Provides an introduction to information systems security, an in depth review of topics in cyber-crime issues in the public safety field and identifies methods of preventing cyber-crime in organizations. It includes issues involved with policy and legal issues of enforcement of cyber-crime laws, as well as tools used for network security.
(3-0-3)

PA 539
Local Government Management
Examines the governmental structure in which public safety administrators work and studies the interrelationship of public safety administrators with the rest of the organization. The leadership and management roles of public safety officials, finances and budgeting in local government, and ethics in the profession will be examined.
(3-0-3)

PA 540
Dispute Resolution
Reviews development of merit-based civil service, examining implications of political accountability, and patronage and professional responsibility. Considers personnel recruitment, examination and promotion procedures in light of collective bargaining, affirmative action, and employee productivity and performance evaluation. Prerequisite: PA 501.
(3-0-3)

PA 541
Performance Measures in Public and Nonprofit Management
Governments at all levels, as well as foundations, trusts and other funders now require performance measurement systems to improve management and gain the power to demonstrate results to officials, taxpayers, donors and decisions makers. This is an applied course which will help students understand performance measurement concepts, develop specific performance measures, and apply performance measurement techniques to solve real world problems in both the nonprofit and public sectors.
(3-0-3)

PA 542
Agency Planning and Policy Analysis
Designed to present practical, costeffective techniques that can be used to make better decisions regarding the allocation of scarce resources. Includes problem identification, goal development, data needs and collection, generation of alternative solutions, projecting impacts, goalsoriented evaluation and strategies for implementation. Prerequisite: PA 501.
(3-0-3)

PA 543
Public Policy, Nonprofits, and Philanthropy
Examines the long history of charitable giving across the globe, with special emphasis on the United States. In particular this course will focus on the philosophical roots of philanthropy, organized giving, and the role philanthropy has played in the development of modern public policy, as it pertains to health and human services.
(3-0-3)

PA 551
Public Infrastructure Management
Considers the status and operation of public infrastructure facilities in the United States generally and in the Chicago metropolitan area, with particular attention to the responsibilities and roles of the public works manager. Explores the relationships between the engineering, administrative and political aspects of public works management. Focuses on critical infrastructure issues through case studies.
(3-0-3)

PA 552
Human Services Policy and Administration
Examines the major issue associated with the administration and operation of social welfare and health services in the United States by governments and nonprofit organizations. Designed for students who work in such agencies and for those who have regular contact with them or their clientele. Structure, funding, staffing and other operating characteristics are examined.
(3-0-3)

PA 553
Public Safety Administration
Deals with contemporary public safety and security management in communities for public safety professionals, public administrators and law enforcement officials who deal with public safety issues, existing in post-9/11 American society. Examines the relationship between police/public safety policy, operations and administration. Addresses various current problems and issues through case studies. Focuses mainly on the City of Chicago and surrounding metropolitan area.
(3-0-3)

PA 555
Introduction to Urban and Regional Planning
Governmental and private sector activities that influence the maintenance and development of the built environment. Students learn both quantitative and qualitative analysis and are introduced to planning systems incorporating fiscal analysis, social analysis, transportation analysis, demographic and economic analysis. They will also learn about various processes providing participation and citizen input to the development of plans for the built environment. Regulatory tools covered include zoning, comprehensive plans, neighborhood planning and subdivision regulation.
(3-0-3)

PA 556
Management Strategy and Tools in the 21st Century
In the United States, an increasing proportion of the goods and services traditionally provided by governmental employees in the context of a governmental bureaucracy are now provided by outside contractors, or through indirect means such as social, economic regulation, tax policy, loan guarantees, vouchers, and manipulation of incentives for the private sector. This course is intended to provide students with an understanding of various tools used by governments throughout the West as the traditional rule based bureaucracy is replaced by other types of institutions and other means to provide goods and services traditionally provided by government.
(3-0-3)

PA 557
Urban and Regional Development
Covers materials on infrastructure management, and the interrelationship of infrastructure management to urban and regional development. The course acquaints students with the increasing role of the private sector in infrastructure maintenance, development, and management. Students learn various analytic techniques useful for officials responsible for urban and regional development (including development of new infrastructure) and for the continuing maintenance and management of existing infrastructure. Students learn analytic techniques relating to management and planning.
(3-0-3)

PA 558
Energy and Environment Policy
Places energy and environmental policy in domestic and global contexts. Traces the economic and political implications of dependence on fossil fuels and the attempt to develop alternate energy sources and promote conservation. Assesses the environmental effects of resource consumption and the effort to control these effects by increased efficiency and regulation of pollution. Explores such problems such as nuclear waste, acid rain, global warming, and deforestation. Examines national and international attempts at economic, political, and technological solutions.
(3-0-3)

PA 559
Issues in Globalization
Globalization has become a powerful buzzword in social science and in popular discourse. This course utilizes a sociological perspective to examine the economic, socio-political, and cultural aspects of globalization within the context of contemporary debates about the phenomenon.
(3-0-3)

PA 560
Political Economy
exploring the relationship between economy and government or political system. Role of the state, role of the market, impact of the economic ideologies on political and economic systems will be examined. Structure of political and economic interests and the mediating effects of institutions on political and economic outcomes will be examined. Normative issues connected to ideal political and economic institutions and appropriate political and economic institutions and outcomes will be examined.
(3-0-3)

PA 561
The Political Process and Administration
Addresses the relation between democratic institutions and processes of American politics and the administrative agencies of government. Examines obligations of citizenship, influence of private interests on public purposes, and effects of demographic, economic and technological change on self-government.
(3-0-3)

PA 562
Urban and Metropolitan Government
Analyzes the decision-making process in urban and metropolitan governments. Emphasizes the role of elected and appointed officials, business, organized labor, community organizations and the electorate. Also focuses on the major problems of city-suburban relations.
(3-0-3)

PA 565
The Nonprofit Sector
Considers the role played by the nonprofit sector in the larger American society and economy. Topics include major organizational forms, financial management, human resource policies, leadership, board-executive relations, and private-public connections.
(3-0-3)

PA 566
Nonprofits and the Public Sector
Provides an overview of the complex and important relationship between government and nonprofits. This course includes a review of the history, funding schemes, the differences between grant and contract funding, recent trends, and much more.
(3-0-3)

PA 567
Regulatory Policy and Politics
Examines the changing role of government regulation of private and public activities from a political and administrative perspective. Explores the reasons for growth and reform of economic and social regulation. Investigates the regulatory process, including standards for rule-making and the involvement of organized groups and the courts.
(3-0-3)

PA 568
International Business, Strategy, and Government
This course provides both public and private sector perspectives in a globalizing environment. The course traces the evolution of industrial systems in various countries and the institutions that participate in the world economy. Th foundations of international business and strategy are studied and applied to cases involving public and private sectors, with emphasis on global strategy, leadership, economic development, and the world economy. An emphasis on the role of government and on Strategic Competitiveness will be emphasized more than normally covered in other international business and strategy courses.
(3-0-3)

PA 570
Social Capital and the Community
The 21st century confronts the public sector with new challenges and opportunities. Many of these challenges and opportunities will take place on the community level; and many of those challenges and opportunities will be centered on the notion of social capital and the community. Social Capital means the building of and use of community assets, those resources available to the community through its residents or citizens, associations, institutions, and its economic life. Using an Asset Based Community Development Approach the objective of this course is to help the student understand and use the concepts of asset based approaches to social capital and community as it relates to public administration.
(3-0-3)

PA 577
Topics in Public Management
A reading and seminar course on a contemporary topic in public administration or policy. Subject matter will change in successive offerings of the course. May be taken more than once.
(Credit: Variable)

PA 579
Ethics and Professional Responsibility in Public Service
Focuses on the ethical problems and issues faced by individuals in public service organizations. Examines questions related to corruption, abuse of power, financial impropriety, ethics codes and standards in government and professional fields, whistle-blowing, and many other topics related to front-page concerns and individual problems of conscience and judgment. Traces the growth of concern about the standards of ethical behavior in government in the U.S.
(3-0-3)

PA 588
Incident Response, Disaster Recovery and Business Continuity
Students learn to design and manage key business information security functions including incident response plans and incident response teams; disaster recovery plans; business continuity plans; and crisis management teams and plans. Reporting, response planning and budgeting are all addressed. Students working in teams will prepare an incident response, disaster recovery, business continuity, or crisis management plan for a real world organization such as a business or a governmental body or agency.
(3-0-3)

PA 590
Internship in Public Administration
Supervised practical experience in public administration. May be taken only by students lacking extensive work experience in governmental administration. Prerequisites: PA 501 and departmental permission.
(Credit: Variable)

PA 592
Directed Readings in Public Administration
Consists of independent reading and analysis centered on particular problems and supervised by a member of the public administration faculty. Prerequisite: Instructors consent.
(Credit: Variable)

PA 597 Credit:
Special Problems
Subject matter will vary with the interests and background of the students and the instructor. May be taken more than once.
(3-0-3)

Variable, Max 6 hours

PA 600
Continuation of Residence.
(0-0-1)

Technical Communication (Lewis Department of Humanities)

Siegel Hall 218
3301 S. Dearborn St.
Chicago, IL 60616
312.567.3465
humoffice@gmail.com
www.iit.edu/csl/hum/programs/grad

Chair:
Maureen Flanagan, Department of Humanities

Co-Directors, Graduate Studies:
Kathryn Riley
Warren S. Schmaus
gradhuminfo@iit.edu

Technical communication addresses two concerns: the effective communication of technical information (to both technical and lay audiences), and the effective use of technology to convey, manage, and analyze information, especially in business, industry, education, and government. Thus technical communicators may take on challenges as diverse as designing an effective e-commerce website, writing instructional materials for a training course, or evaluating the understandability of synthetic speech.

The Lewis Department of Humanities' graduate programs in technical communication prepare students for professional, academic, and research careers in technical communication. Master's students develop their knowledge of principles for communicating effectively in traditional and electronic media, often with an emphasis on workplace applications. Doctoral students develop the theoretical and methodological foundations for conducting original research in a rapidly evolving and often interdisciplinary field. Class schedules accommodate working professionals, and students may enroll on either a full-time or part-time basis.

Degrees Offered

Master of Science in Technical Communication and Information Design
Master of Science in Information Architecture
Doctor of Philosophy in Technical Communication

Certificate Programs

Instructional Design
Technical Communication

Research Facilities

The department supports a Usability Testing and Evaluation Center; an editing center, Edit IIT; Gewgaws Lab, a physical and virtual design production lab focused on open source; and a Speech Analysis Lab for applied research on natural and synthesized speech. IIT's Galvin Library subscribes to more than 120 electronic databases with more than 25,000 full-text journals and is part of CARLI, which through I-Share provides access to more than 32 million items across Illinois academic library collections. Students have access to computer labs across the IIT campus, some of which also serve as classrooms for technical communication courses.

Research Areas

Humanities department faculty conduct research in a wide range of areas. Among those especially relevant to technical communication are aesthetics; document and online design; ethics in the professions; history of art and architecture; humanizing technology; information seeking and retrieval; instructional design; intellectual property; knowledge management; linguistics; philosophy of science; rhetorical theory; social media; text analysis; and usability testing.

Faculty

Matthew J. Bauer, Assistant Professor of Linguistics and Director of the Speech Analysis Lab. B.A., University of Minnesota, Duluth; M.S., Ph.D., Georgetown University.

Glenn J. Broadhead, Associate Professor of English. B.A., Los Angeles State College; M.A., Ph.D., University of California, Davis.

James Dabbert, Senior Lecturer, English, Director of the Writing Center, and Associate Director of ESL. B.A., M.A., Indiana University.

Michael Davis, Professor of Philosophy. B.A., Western Reserve University; Ph.D., University of Michigan.

Maureen Flanagan, Professor of History and Chair of the Humanities Department. B.A., Dominican College; Ph.D., Loyola University of Chicago.

Libby Hemphill, Assistant Professor of Technical Communication. A.B., University of Chicago; M.S., Ph.D., University of Michigan.

Robert F. Ladenson, Professor of Philosophy. B.A., University of Wisconsin; Ph.D., Johns Hopkins University; J.D., DePaul University.

Jahna Otterbacher, Assistant Professor of Technical Communication. B.A., M.A., University of Michigan; M.A., Boston University; Ph.D., University of Michigan.

Margaret Power, Professor of History. B.A., Ph.D., University of Illinois, Chicago.

Gregory J. Pulliam, Senior Lecturer, English, Associate Chair of the Humanities Department, Undergraduate Advisor, and Director of ESL. B.A., Memphis State University; M.A., Ph.D., University of Missouri.

Kathryn Riley, Professor of English, Co-Director of Graduate Studies, and Director of Edit IIT. B.A., University of Maryland; M.A., Georgia State University; Ph.D. (English), University of Maryland; Ph.D. (Linguistics), Louisiana State University.

Warren S. Schmaus, Professor of Philosophy and Co-Director of Graduate Studies. A.B., Princeton University; M.A., Ph.D., University of Pittsburgh.

John W. Snapper, Associate Professor of Philosophy and Academic Policy Coordinator. B.A., Princeton University; M.A., Ph.D., University of Chicago.

Karl A. Stolley, Assistant Professor of Technical Communication, Director of Gewgaws Lab, and Co-Director of the Usability Testing and Evaluation Center. B.A., Millikin University; M.A., Ph.D., Purdue University. http://karlstolley.com

Admission Guidelines (Master's Degrees)

Applicants to the master's program come from a variety of backgrounds. Some students enter with strong writing or design ability and learn to apply those skills in technical and scientific areas, while other students enter with a technical or scientific background and learn to enhance their communication skills. The program's goal is to help students build upon existing strengths and develop new areas of expertise.

Applicants must have a bachelor's degree from an accredited four-year institution with a minimum cumulative GPA of 3.0/4.0.

In addition to the application form, the applicant must submit the following:

1. Professional statement discussing the applicant's professional and academic preparation and goals
2. Two letters of recommendation from faculty of supervisors who can evaluate the applicant's potential for graduate-level work
3. Official transcripts, or certified copies thereof, of all academic work at the college level or above
4. Required test scores

All applicants are required to submit Graduate Record Exam (GRE) scores with a minimum combined score of 1000 quantitative + verbal (with a minimum score of 500 in each area) and 3.0 (analytical writing).

International students must submit TOEFL scores unless they are exempt as specified in the International Applicant Requirements of this bulletin. The minimum TOEFL score is 95, with minimum section scores of 20 each in the Listening, Reading, and Writing sections.

Note: Enrolling in courses does not guarantee later acceptance into a degree program, nor does meeting the minimum admission requirements. Students who enter as non-degree or certificate students should first discuss their plans with one of the co-directors of graduate studies.

Admission Guidelines (Ph.D. Program)

The doctoral program in technical communication at IIT prepares students for careers in research and teaching at the postsecondary level, as well as for advanced supervisory and research positions in business and government. Building on a base of skills in workplace practices, the program incorporates theory-oriented advanced readings, seminars, and dissertation research leading to original contributions to scholarship in the field.

Students enter the Ph.D. program from a wide range of fields, but should have substantial academic preparation or professional experience related to technical communication.

Applicants must have completed a bachelor's or master's degree in a field that, in combination with the 27-credit-hour technical core, would provide a solid basis for advanced academic work leading to original research in the field. The relevance of previous degrees to the doctoral program will be assessed by the department's graduate admissions committee.

In addition to the application form, the applicant must submit the following:

1. Professional statement discussing the applicant's professional and academic preparation, research interests, and goals
2. Three letters of recommendation from faculty or supervisors who can evaluate the applicant's potential for advanced academic work
3. Official transcripts, or certified copies thereof, of all academic work at the college level or above
4. Required test scores

All applicants are required to submit Graduate Record Exam (GRE) scores with a minimum combined score of 1000 quantitative + verbal (with a minimum score of 500 in each area) and 3.0 (analytical writing).

International students must submit TOEFL scores unless they are exempt as specified in the international Applicant Requirements of this bulletin. The minimum TOEFL score is 95, with minimum section scores of 20 each in the Listening, Reading, and Writing sections.

Note: Enrolling in courses does not guarantee later acceptance into a degree program, nor does meeting the minimum admission requirements. Students who enter as non-degree or certificate students should first discuss their plans with one of the co-directors of graduate studies.

Master of Science in Technical Communication and Information Design

33 credit hours (project option) or 30 credit hours (thesis option)
Project review or comprehensive examination
Project or Thesis

The M.S. in Technical Communication and Information Design provides an understanding of communication practices, familiarity with information and communication technologies, and an awareness of the importance of collaboration in enhancing the flow of information throughout an organization.

Students preparing for careers as technical communicators are advised to take the project option, while students preparing for a Ph.D. may wish to take the thesis option. Students may apply up to six hours of credit in one of the following courses: COM 594 (Project) or COM 591 (Thesis).

Required courses

COM 525 Usability Testing and Evaluation
COM 528 Document Design
COM 529 Technical Editing
COM 530 Standards-Based Web Design
COM 543 Publication Management

Electives

COM 428 Verbal and Visual Communication
COM 430 Introduction to Web Design and Management
COM 431 Intermediate Web Design and Management
COM 432 Advanced Web Design and Management
COM 435 Intercultural Communication
COM 501 Introduction to Linguistics
COM 506 World Englishes
COM 508 Structure of Modern English
COM 509 History of the English Language
COM 515 Discourse Analysis
COM 532 Rhetoric of Technology
COM 535 Instructional Design
COM 536 Proposal and Grant Writing
COM 538 Entrepreneurship in Technical Communication
COM 541 Information Structure and Retrieval
COM 542 Knowledge Management
COM 545 Writing for Academic Publication
COM 553 Globalization and Localization
COM 561 Teaching Technical Communication
COM 571 Persuasion
COM 577 Communication Law and Ethics
COM 580 Topics in Communication
COM 585 Internship
COM 601 Research Methods and Resources

Other courses as approved by the student's advisor and one of the co-directors of graduate studies. No more than 9 hours of 400-level courses may be counted toward the degree.

Master of Science in Information Architecture

36 credit hours (project option) or 33 credit hours (thesis option)
Project review or comprehensive examination
Project or Thesis

The M.S. in Information Architecture enhances a technical communication core with specialized concepts, skills, and tools for designing, implementing, and managing websites and related digital media. This degree provides students with expertise for a number of tasks relevant to mid-level and advanced positions in the workplace: website design, website project management, information structure and retrieval, knowledge management, and usability testing and evaluation.

Students preparing for careers as technical communicators are advised to take the project option, while students preparing for a Ph.D. may wish to take the thesis option. Students may apply up to six hours of credit in one of the following courses: COM 594 (Project) or COM 591 (Thesis).

Required courses

COM 525 Usability Testing and Evaluation
COM 528 Document Design
COM 530 Standards-Based Web Design
COM 541 Information Structure and Retrieval
COM 542 Knowledge Management
COM 543 Publication Management

Electives

COM 428 Verbal and Visual Communication
COM 430 Introduction to Web Design and Management
COM 431 Intermediate Web Design and Management
COM 432 Advanced Web Design and Management
COM 435 Intercultural Communication
COM 501 Introduction to Linguistics
COM 506 World Englishes
COM 508 Structure of Modern English
COM 509 History of the English Language
COM 515 Discourse Analysis
COM 532 Rhetoric of Technology
COM 535 Instructional Design
COM 536 Proposal and Grant Writing
COM 538 Entrepreneurship in Technical Communication
COM 541 Information Structure and Retrieval
COM 542 Knowledge Management
COM 545 Writing for Academic Publication
COM 553 Globalization and Localization
COM 561 Teaching Technical Communication
COM 571 Persuasion
COM 577 Communication Law and Ethics
COM 580 Topics in Communication
COM 585 Internship
COM 601 Research Methods and Resources

Other courses as approved by the student's advisor and one of the co-directors of graduate studies. No more than 9 hours of 400-level courses may be counted toward the degree.

Doctor of Philosophy in Technical Communication

84 credit hours beyond the bachelor's degree, including

- Technical communication core (27 credit hours)
- Electives (minimum of 18 credit hours)
- Dissertation research (minimum of 24 credit hours)
- Additional electives or dissertation research (as needed to achieve total of 84)

Qualifying examination
Comprehensive examination
Dissertation
Dissertation examination

Transfer Units

Students who have already earned master's degrees or undertaken graduate work in relevant fields may transfer credit hours toward the doctoral degree (up to 36 credit hours for graduate coursework in relevant fields at IIT, up to 30 credit hours for graduate coursework in relevant fields at other institutions).

Course Requirements (Details)

Required Courses

Technical Communication Core (27 credit hours):

COM 521 Key Concepts in Technical Communication
COM 525 Usability Testing and Evaluation
COM 529 Technical Editing
COM 541 Information Structure and Retrieval
COM 542 Knowledge Management
COM 543 Publication Management
COM 601 Research Methods and Resources

One of the following:

COM 528 Document Design
COM 530 Standards-Based Web Design
COM 535 Instructional Design

One of the following:

COM 501 Introduction to Linguistics
COM 506 World Englishes
COM 508 Structure of Modern English
COM 509 History of the English Language
COM 515 Discourse Analysis

Electives (at least 18 credit hours)

COM 501 Introduction to Linguistics
COM 506 World Englishes
COM 508 Structure of Modern English
COM 509 History of the English Language
COM 515 Discourse Analysis
COM 528 Document Design
COM 530 Standards-Based Web Design
COM 532 Rhetoric of Technology
COM 535 Instructional Design
COM 536 Proposal and Grant Writing
COM 538 Entrepreneurship in Technical Communication
COM 545 Writing for Academic Publication
COM 553 Globalization and Localization
COM 561 Teaching Technical Communication
COM 571 Persuasion
COM 577 Communication Law and Ethics
COM 580 Topics in Communication

Other courses as approved by the student's advisor and one of the co-directors of graduate studies. No more than 9 hours of 400-level courses may be counted toward the degree.

Dissertation Research

COM 691 Research and Dissertation for Ph.D. degree (at least 24 credit hours)

Additional Courses

Additional coursework or dissertation research sufficient to meet the requirement of 84 credit hours beyond the bachelor's degree. All work for a doctoral degree should be completed within six calendar years after the approval of the program of study; if it is not, then the student must re-pass the Qualifying Examination.

Examinations

The Qualifying examination is a structured discussion based on a portfolio consisting of four elements: (1) deliverables and explanatory material for a master's-level project (or its equivalent); (2) a collection of significant course papers and assignments completed as part of the Technical Communication Core (or as part of equivalent study elsewhere); (3) a bibliographic essay identifying significant trends in recent research in technical communication (or successful completion of COM 521, Key Concepts in Technical Communication); (4) a substantial essay that introduces and analyzes the other materials in the portfolio and shows how they constitute a coherent program of study in preparation for advanced work toward the doctorate. The examining committee must include a minimum of four faculty members. The Qualifying Exam must be taken within the first year of work toward the doctoral degree, and the student must be registered when the exam is administered. If the student fails the Qualifying Examination, the examining committee may recommend a re-examination. At least one semester of additional preparation is considered essential before re-examination. The second chance for taking the Qualifying Exam is regarded as final. Any additional considerations must be petitioned and approved by the graduate dean.

The Comprehensive Examination is a structured discussion based on (a) a portfolio of course papers, projects, and readings completed as part of coursework undertaken in preparation for the doctorate, along with (b) a proposal for the doctoral dissertation. The examinee should demonstrate expertise in the area or areas relevant to the proposed dissertation. The examining committee must consist of at least four tenured or tenure-track faculty members, including three members of the technical communication faculty and one other faculty member from a Ph.D.-granting academic unit at IIT other than the Humanities Department. In some cases, students may wish to add a fifth member from the Humanities Department. Students usually take the Comprehensive Exam at the end of the second year of doctoral study, but no later than one year prior to the Dissertation Examination. The student must be registered at the time of the exam.

The Dissertation Examination is a structured discussion of the dissertation and its scholarly context. Like the Comprehensive Examination Committee, the Dissertation Committee must consist of at least four tenured or tenure-track faculty members, including three from technical communication and one from a Ph.D.-granting academic unit at IIT other than the Humanities Department. (This exam is called the Final Thesis Examination in the current Graduate Bulletin.)

Dissertation

The dissertation should constitute an original contribution to scholarship in technical communication and may address areas of interaction between technical communication and other disciplines (e.g., history, linguistics, literature, philosophy, and rhetoric/composition). The research topic and method may be empirical (perhaps employing the facilities of the Usability Testing and Evaluation Center or Speech Analysis Lab), pedagogical, historical, or theoretical.

Certificate Programs

Admission Guidelines

Applicants must have a four-year bachelor's degree from an accredited institution with a minimum cumulative GPA of at least 2.5/4.0 and must be admitted as a graduate certificate student. Certificate students who later apply to one of the department's M.S. programs or the Ph.D. program must meet the admission guidelines for that program. All coursework taken toward a certificate in technical communication or in instructional design and passed with a grade of "B" or better may also be applied to the M.S. in Technical Communication and Information Design, the M.S. in Information Architecture, or the Ph.D. in Technical Communication (for students who are admitted to one of those programs), as long as those courses were not applied to another degree. However, no more than 9 hours of 400-level coursework may be counted toward a degree program.

Certificate in Technical Communication

This certificate is designed for students seeking an entry-level position as a technical communicator in a broad range of fields (e.g., industry, manufacturing, health care, publishing and advertising, and government agencies). The program consists of 12 credit hours of coursework (four courses).

Required courses

COM 525 Usability Testing and Evaluation
COM 528 Document Design **OR**
COM 424 Document Design
COM 529 Technical Editing **OR**
COM 425 Editing
AND One of the following:
COM 530 Standards-Based Web Design
COM 428 Verbal and Visual Communication
COM 435 Intercultural Communication
COM 523 Communicating Science

Certificate in Instructional Design

This certificate is primarily for experienced technical communicators who wish to acquire focused competency in instructional design. Graduates of this certificate program can serve as information specialists to systematically design and develop instructional materials and training programs for businesses, individuals, health and education institutions, and government. This certificate teaches the core concepts, instructional methods, and assessment instruments for designing materials using various forms of text, visual media, technology, and instructional techniques. The program consists of 15 credit hours (five required courses).

Required courses

COM 424 Document Design **OR**
COM 528 Document Design
COM 525 Usability Testing and Evaluation
COM 530 Standards-Based Web Design
COM 535 Instructional Design
COM 542 Knowledge Management

Course Descriptions

Numbers in parentheses indicate class, lab, and credit hours, respectively.

COM 501
Introduction to Linguistics
An introduction to the systematic study of language. Focus on the core areas of linguistics, such as sound patterns of language (phonology), form (syntax, morphology) and meaning (semantics, pragmatics), as well as applied areas, such as language variation, language acquisition, psychology of language, and the origin of language.
(3-0-3)

COM 506
World Englishes
Analysis of the variations of the English language throughout geographic and cultural regions of the world.
(3-0-3)

COM 508
Structure of Modern English
Analysis of English grammar from four major perspectives: prescriptive, descriptive, transformational-generative, and contextual perspectives. Different methods for analyzing sentences, ways of applying each method to problems in editing and writing, and contributions of linguists such as Noam Chomsky. While focusing on sentence structure, students also look at the structure of words (morphology) and larger units of text (discourse) at various points in the semester.
(3-0-3)

COM 509
History of the English Language
Study of the origins and development of key features of the English language through its important stages, including Old, Middle, and Early Modern English.
(3-0-3)

COM 515
Discourse Analysis
Analysis of spoken and written texts on the intersentential and metalinguistic levels (e.g., semantic roles; given-new information; deixis and anaphora; presupposition and entailment; direct and indirect speech acts; schema theory). Applications to social and professional issues such as intercultural communication; sociopolitical discourse; discourse in educational, legal, and medical settings; narratives and literary texts.
(3-0-3)

COM 521
Key Concepts in Technical Communication
Broad coverage of concepts and issues in current and classic scholarship in the field of technical communication.
(3-0-3)

COM 523
Communicating Science
This course focuses on strategies for communicating scientific information in professional settings. Students develop a literature review, proposal, and feasibility study; learn how to adapt scientific information to various audiences; and complete exercises on style, grammar, and other elements of effective professional communication. Emphasis on usability, cohesion, and style in each assignment.
(3-0-3)

COM 525
Usability Testing and Evaluation
An introduction to methods available for conducting research and usability testing. Students will learn how to plan and conduct tests that measure the efficiency and effectiveness of a design or product. Course work includes identifying and testing tasks, interpreting data, and reporting findings.
(3-0-3)

COM 528
Document Design
Principles and strategies for effective document and information design, focusing on print media and familiarizing students with current research and theory as well as with practices in document design. Students design, produce, and evaluate documents for a variety of applications, such as instructional materials, brochures, newsletters, graphics, and tables.
(3-0-3)

COM 529
Technical Editing
Principles and strategies for editing at all levels, working with both hard and soft copy. Includes practice in copymarking, copyediting, proofreading, editing for grammar and style, and comprehensive editing. Attention primarily to documents from science, technology, and business.
(3-0-3)

COM 530
Standards-Based Web Design
Theory and practice of structuring and designing information for web-enabled devices. This course emphasizes web standards, accessibility, and agile design methods.
(3-0-3)

COM 532
Rhetoric of Technology
A course that explores the theoretical and applied intersections of the rhetorical tradition and digital communication technologies.
(3-0-3)

COM 535
Instructional Design
Teaches the essentials for the development of instructional materials, including analysis of human performance problems, strategic interventions, specified learning tasks, and validation instruments.
(3-0-3)

COM 536
Proposal and Grant Writing
Course covers all aspects of federal and foundation proposal cycle, from proposal development through review and decision-making process. Emphasis on research proposals incorporating quantitative and qualitative methods, but activity-based proposals addressed as well.
(3-0-3)

COM 538
Entrepreneurship in Technical Communication
Corporate and independent roles of technical communicators. Concepts and techniques needed to market services or to address the marketing needs of clients. Modes, goals and strategies for verbal and written interaction with clients, corporate decision-makers, and communication staff, with attention to presentation technologies.
(3-0-3)

COM 541
Information Source and Retrieval
An examination of conceptual foundations and applied uses of structured languages and databases for structuring information, with an emphasis on approaches to single-sourcing materials for presentation in digital and print formats.
(3-0-3)

COM 542
Knowledge Management
Analysis of the nature and uses of systems and knowledge in business and professional settings, focusing on the technical communicator's roles and tasks in generating and transferring data, information and knowledge within organizations.
(3-0-3)

COM 543
Publication Management
Intensive work developing and using systems to create and deliver content digitally and in print. Special emphasis on project management and large-team collaboration. Prereq/Coreq: COM 530, COM 541, or COM 542.
(3-0-3)

COM 545
Writing for Academic Publication
Practice in developing written and spoken academic genres (e.g., reviews, articles, conference papers, CVs, job talks). Special attention to analyzing and evaluating academic journals; submitting items to journals and conferences; managing time during the research, writing, and publication process; revising work and providing feedback to others; and mastering the conventions of academic writing.
(3-0-3)

COM 553
Globalization and Localization
Localization and globalization in international communication. Special problems in managing publication projects for global audiences (acontextual) and local audiences (highly contextualized), with emphasis on design issues, personnel issues, quality assurance, software internationalization, and ISO 9000 standards.
(3-0-3)

COM 561
Teaching Technical Communication
Principles, strategies, and resources for teaching technical communication and for developing and assessing technical communication curricula, especially at the postsecondary level.
(3-0-3)

COM 571
Persuasion
The study of covert and overt persuasion and their influences on society and individuals.
(3-0-3)

COM 577
Communication Law and Ethics
This course explores ethical and legal issues concerning communication in diverse contexts: mass media (e.g., print, broadcast, and electronic); government and politics; organizations (e.g., workplaces in public and private sectors); academic life (e.g., classroom, student, and faculty affairs); and interpersonal relations (e.g., love, friendship, marriage). Students research and write an article-length paper, and may also do additional research and/or classroom work. Prerequisite: Graduate standing.
(3-0-3)

COM 580
Topics in Communication
An investigation into a topic of current interest in communication, which will be announced by the instructor when the course is scheduled. Advanced study of communication issues, theories, and practices relevant to science, technology, and industry settings. Repeatable for up to 9 credit hours.
(3-0-3)

COM 585
Internship
The internship is a cooperative arrangement between IIT and industry. It provides students with hands-on experience in the field of technical communication and information design. Credit: Variable.
(3-0-3)

COM 591
Thesis
Individual study of a topic relevant to a degree or certificate in technical communication, information design, or instructional design.
(3-0-3)

COM 594
Project
Projects will require students to complete a theoretically based analysis of a practical communication situation, create a document appropriate to the situation, and write an analysis of or commentary on the choices made in the production of the document. (Credit: Variable. Most M.S. students take six credits of project studies.)
(3-0-3)

COM 597
Special Problems
Advanced topics in literature, language or communication studies.

COM 601
Research Methods and Resources
This course addresses the logic of research design. The first part of the course focuses on formulating clear research questions and hypotheses. The second part addresses various designs (surveys, correlations, experiments, mixed designs, etc.) and their potential to test hypotheses.
(3-0-3)

COM 691
Research and Thesis for Ph.D
This is a variable credit course for Ph.D. candidates working on their dissertation. Credit hours: 1-20. Prerequisites: Ph.D. candidates only.

Undergraduate Courses Available to Graduate Students

COM 401
Advanced Composition and Prose Analysis
Critical analysis of various types of prose, with stress on the art as well as the craft of writing. The student is required to write several critical papers. Prerequisite: Satisfaction of IIT's Basic Writing Proficiency Requirement. (**C**)
(3-0-3)

COM 421
Technical Communication
Principles and practice in the communication of technical materials. Students work on the design, writing and revising of reports, articles, manuals, procedures and proposals, including the use of graphics. Works by modern writers are analyzed. Credit not granted for both COM 421 and MT 301. Prerequisite: Satisfaction of IIT's Basic Writing Proficiency Requirement.(**C**)
(3-0-3)

COM 423
Communication in the Workplace
A study of communication related to science and technology in entrepreneurial, corporate, government, and public service environments. This course focuses on problem-solving genres (proposals and recommendation reports) and on common patterns of ideas found in such documents (e.g., process/steps, whole/parts, event/effects, event/causes, claim/reasons). Prerequisite: Satisfaction of IIT's Basic Writing Proficiency Requirement.(**C**)
(3-0-3)

COM 424
Document Design
Principles and strategies for effective document and information design, focusing on print media. Students design, produce, and evaluate documents for a variety of applications, such as instructional materials, brochures, newsletters, graphics, and tables.
(3-0-3)

COM 425
Editing
Principles and strategies for editing at all levels, working with both hard and soft copy. Includes practice in copymarking, copyediting, proofreading, editing for grammar and style, and comprehensive editing. Attention primarily to documents from science, technology, and business.
(3-0-3)

COM 428
Verbal and Visual Communication
Introduces students to the issues, strategies, and ethics of technical and professional presentation, and provides students with opportunities to engage in public address, video presentations and conferencing, and group presentations. Analysis of audience types and presentation situations, group dynamics, persuasive theories, language and mass media.
(3-0-3)

COM 430
Introduction to Web Design and Management
Presupposing only that students know how to use a web browser, this course teaches beginning HTML, basic page layout and design principles, basic multimedia, and the structures of websites, and also introduces students to WYSIWYG webpage-generation software and FTP software.
(3-0-3)

COM 431
Intermediate Web Design and Management
A continuation of COM 430, this course goes more deeply into HTML, multimedia, and some of the advanced features of WYSIWIG editors. Prerequisite: COM 430 or permission of instructor.
(3-0-3)

COM 432
Advanced Web Design and Management
A continuation of COM 430 and COM 431, this course covers the most current web technologies. Prerequisite: COM 431 or permission of instructor.
(3-0-3)

COM 435
Intercultural Communication
An introduction to the problems of communication across cultures, with emphasis on the interplay of American civilization with those of other cultural areas. Prerequisite: A 100-level humanities course and junior standing.(**H**)(**C**)
(3-0-3)

COM 437
Video Documentation
Planning and managing digital-video projects to document concepts and procedures in technology, science, business, and education. Attention to scripting, shooting, editing, and distribution media. Students will work on individual activities and collaborate on a community-service or other client-centered project.(**H**)(**C**)
(3-0-3)

COM 438
Technical Exhibit Design
Planning and managing informative and instructional exhibits in technical, scientific, and business contexts. Attention to characteristics and constraints of space, multimedia, and other resources, along with principles and goals of viewer access and flow. Students will work on individual activities and collaborate on a community-service or other client-centered project. Instruction will incorporate Chicago-area resources such as the Museum of Science and Industry.(**C**)
(3-0-3)

COM 440
Introduction to Journalism
Introduction to the principles and practices of modern American journalism. Students will analyze news stories and media, and will cover and report on campus area events. Student-generated news stories will be discussed, analyzed and evaluated. Prerequisites: A 100-level humanities course.(**H**)(**C**)
(3-0-3)

Other Undergraduate Courses Available to Graduate Students

AAH 491
Independent Reading and Research in Art and Architectural History

HIST 491
Independent Reading and Research in History

PHIL 491
Independent Reading and Research in Philosophy

Officers and Faculty, Locations, and Indices

Board of Trustees

University Administration

Faculty Emeriti

Maps and Directions

Faculty Index

Bulletin Index

Board of Trustees

Officers

Chairman of the Board
John W. Rowe*
Chairman and Chief Executive Officer
Exelon Corporation

Vice Chair and Chairman of the Executive Committee
Craig J. Ducchossois*
Chief Executive Officer
The Ducchosois Group, Inc.

Chairman of the Policy Committee
Robert A. Pritzker '46*
President and Chief Executive Officer
Colson Associates, Inc.

Vice Chair and Chair of the Trusteeship Committee
David J. Vitale*

Vice Chair
Edward L. Kaplan '65*
President
Nalpak, Inc.
Chairman Emeritus
Zebra Technologies

Vice Chair
Victor A. Morgenstern '64*
Chairman
Valor Equity Partners

President
John L. Anderson
Illinois Insitute of Technology

University Regents

Robert W. Galvin
Chairman Emeritus
Motorola, Inc

Robert A. Pritzker '46*
President and Chief Executive Officer
Colson Associates, Inc.

M. A. Self
President
Allen Financial, Inc

Board Members

Andrew V. Agostini
Principal/Owner
J.L.Woode Ltd. LLC

Bahman Atefi
Chairman and Chief Executive Officer
Alion Science and Technology Corporation

Giuseppe Calabrese
President
Harris mg CFO, Inc

John P. Calamos Sr., '63,'70*
Founder/Chairman/CEO and CIO
Calamos Asset Management, Inc.

A. Steven Crown
General Partner
Henry Crown and Company

James R. Gagnard '69
President and Chief Executive Officer
SmartSignal Corporation

Jamshyd Godrej '72
Chairman and Managing Director
Godrej & Boyce Manufacturing Company, Ltd.

Antonio J. Gracias
CEO and Managing Member
Valor Equity Partners

Marc Hannah '77
Vice President, Technology Development (Retired)
Silicon Graphics, Inc.

Elzie Higginbottom
President and CEO
East Lake Management and Development Corp

Jean K. Holley
Executive Vice President and Chief Information Officer
Tellabs

David C. Hovey Sr. '70
Founder and President
Optima, Inc.

Martin C. Jischke '63*
President Emeritus
Purdue University

Patrick J. Kelly*
Chief Executive Officer
D.P. Holdings, Inc.

James W. Kiley*
President
Kiley Capital, LLC

Eric C. Larson
Founder and Managing General Partner
Linden LLC

F. Christopher Lee
President
Johnson & Lee, Ltd.

Göran Lindahl
Chairman and Chief Executive Officer
LivSAfe Group

Paul F. McKenzie
Vice President, Pharmaceutical Development,Manufacturing Sciences
Johnson & Johnson PRD

Rosemarie Mitchell
Co-Founder and Chief Executive Officer
ABS Associates, Inc.

Anita M. Nagler*

Adrian R. Nemcek '70
Executive Vice President (Retired)
Motorola, Inc.

Satyan Pitroda '66
Chairman
C-Sam, Inc.

Michael A. Pulick
President
Grainger, U.S.A.

Ellen Jordan Reidy '79, '81
President
America's Food Technologies, Inc.

Carl S. Spetzler '63, '65, '68
Chairman
Strategic Decisions Group

Efthimios J. Stojka
Chief Executive Officer
Fast Heat, Inc.

John Tracy
Chief Technology Officer; Senior Vice President of Engineering, Operations and Technology
The Boeing Company

James C. Tyree
Chairman/CEO
Mesirow Financial

Alan W. Wendorf
Chairman, President, and Chief Executive Officer
Sargent & Lundy

Life Trustees

Vernon Armour
William C. Bartholomay
Martin Cooper '50, '57
Robert A. Cornog '61
James E. Cowie
Bryan R. Dunn
Michael P. Galvin '78*
Alvin L. Gorman
Donald E. Goss
Robert L. Growney '74, '82*
Theodore E. Hanson
James Hill , Jr.
Donald R. Hollis
Richard M. Jaffee
Norbert O. Kaiser
Jules F. Knapp
Kaarina Koskenalusta
John H. Krehbiel , Jr.
Thomas E. Lanctot*
Richard A. Lenon
Bruce C. Liimatainen*
Dirk Lohan
Walter Nathan '44
Robert J. Potter
Carole Browe Segal
Bernard F. Sergesketter
William A. VanSanten , Jr. '61
David J. Vitale
Priscilla Anne Walter
Ralph Wanger*

Trustees Emeritus

Harold A. Bergen '50
Heather Bilandic Black
Robert D. Cadieux '59
Calvin A. Campbell , Jr.
S. R. Cho '65
Lewis M. Collens
Albert K. Hawkes '50, '54
Gordon R. Lohman
William B. McCain '53
Werner E. Neuman '49
The Honorable Ilana D. Rovner '66
John R. Schmidt
Lajos Schmidt '54
Raymond C. Towe

* Member of the Board of Trustees' Executive Committee

Administration

Office of the President

John L. Anderson
B.S., M.S., Ph.D.
President

Alan W. Cramb
B.S., Ph.D.
Provost and Senior Vice President Academic Affairs

Sandra L. LaPorte
B.A.
Director
Office of the President

David E. Baker
B.A., M.A.
Vice President for External Affairs

John Collins
B.S., M.S., Ph.D., P.E.
Vice President for Business and Administration

Elizabeth J. Hughes
B.A.
Vice President for Institutional Advancement

Leroy Kennedy
B.S.
Vice President for Community Affairs and Outreach Programs

Patricia Laughlin
Ph.D.
Vice President for Finance and Administration

David L. McCormick
A.B., M.S., Ph.D.
Senior Vice President and Director IIT Research Institute

Mary Anne Smith
B.A., M.S., J.D.
Vice President, General Counsel, and Secretary

Darsh T. Wasan
B.S., Ph.D.
Vice President for International Affairs

Office of the Provost and Senior Vice President for Academic Affairs

Alan W. Cramb
B.Sc., Ph.D.
Provost and Senior Vice President for Academic Affairs

Hamid Arastapoor
B.S., M.S., Ph.D., G.E.
Director, Wanger Institute for Sustainable Energy Research

R. Russel Betts
B.A., M.A., M.S., Ph.D.
Dean of College of Science and Letters

Robert E. Brackett
B.S., M.S., Ph.D.
Director of the Institute for Food Safety and Health

C. Robert Carlson
B.S., M.S., Ph.D.
Dean of the School of Applied Technology and Director of the Rice Campus

Ali Cinar
B.S., M.Eng., Ph.D.
Dean of the Graduate College and Vice President for Research

Natacha de Paola
B.S., M.S., Ph.D.
Carol and Ed Kaplan Armour Dean of Engineering

Gerald P. Doyle
B.A., M.Ed.
Vice Provost for Undergradute Admission and Financial Aid

Douglas A. Geiger
B.A., M.A.
Dean of Students

Michael R. Gosz
B.S., M.S., Ph.D.
Associate Provost for Undergraduate Affairs

Patricia Grow
Director of Finance

Harvey Kahalas
B.S., M.B.A., Ph.D.
Dean of the Stuart School of Business

Noreen M. Kozak
Executive Assistant to the Provost

Harold J. Krent
A.B., J.D.
Dean of the Chicago-Kent College of Law

M. Ellen Mitchell
B.A., Ph.D.
Dean of Institute of Psychology

Dennis Roberson
B.S., M.S.
Vice Provost for New Initiatives

Donna V. Robertson
B.A., M.Arch
Dean of College of Architecture

Christopher Stewart
B.A., M.S., M.L.S.
Dean of Libraries

Ophir Trigalo
B.A., M.B.A.
Chief Information Officer

Vince Turitto
B.ChE., D.Engr.Sci.
Director, Pritzker Institute for Biomedical Science and Engineering

Patrick F. Whitney
B.F.A., M.F.A.
Dean of the Instiute of Design

Office of the Vice President for Business and Operations

John Collins
B.S., M.S., Ph.D., P.E.
Vice President for Business and Operations

Jean Bingham
Associate Vice President of Auxiliary Services

Joseph Clair
P.E.
Director, Campus Energy and Sustainability

Terry Frigo
B.S.
Associate Vice President of Facilities, Rental Properties and Construction

Anna Lockhart
B.A.
Assistant to the Vice President for Business and Operations/Consumer Services Specialist

Jennifer Luttig-Komrosky
B.A., M.Ed.
Director, Housing and Residential Services

Dion A. Manly
B.S.
Business Analyst

Raymond Martinez
B.A.
Director of Public Safety

Bruce A. Mueller
B.B.A., M.B.A.
Chief People Officer

Beverly Perret
B.A.
Director of Human Resources

Office of Communications

Jamie Banuelos
Assistant Director, Marketing

Chelsea Kalberloh Jackson
B.S.
Editorial Services Director

Janet Jaffke
B.F.A.
Director, Web and Electronic Communications

Jon Kavanaugh
Online Content Director

Denise Moriarty
B.S.
Director of Projects

Nancy Schoon
B.S.
Art Director

Evan Venie
B.A.
Associate Director, Marketing

Office of the Vice President for Community Affairs and Outreach Programs

Leroy E. Kennedy
B.A.
Vice President for Community Affairs and Outreach Programs

Office of Corporate Relations and Strategic Initiatives

Dennis Roberson
B.S., M.S.
Vice Provost for New Initiatives

Ruth Z. Sweester
B.A., M.A.
Director of Corporate Relations

Sabrina C. Fesko
B.A.
Progam Manager, Corporate Relations

Office of the Vice President for External Affairs

David E. Baker
B.A., M.A.
Vice President for External Affair

Office of the Vice President for Finance and Administration

Patricia Laughlin
M.A., Ph.D.
Vice President for Finance and Administration, and Treasurer

Anne Berenfield
Assistant to the Vice President for Finance and Administration

Brian M. Laffey
C.P.A.
Associate Vice President for Finance and Controller

David A. Ulaszek
B.A., M.A.B.
Assocaiate Vice President, Finance

Office of the General Counsel

Mary Anne Smith
B.A., M.S., J.D.
Vice President and General Counsel and Secretary

Anthony D. D'Amato
B.A., M.A., J.D.
Deputy General Counsel

Candida Miranda
B.A., J.D., M.B.A.
Associate General Counsel and Director, Equal Opportunity and Affirmative Action

Virginia Ulaszek
Assistant to the Vice President and General Counsel

Office of the Vice Presdent for Institutional Advancement

Elizabeth J. Hughes
B.A.
Vice President, Institutional Advancement

Beth Campbell
B.S., M.B.A.
Associate Vice President, Institutional Advancement

Susan Faraone
B.A., M.S.
Associate Vice President, Development and Campaign Director, Institutional Advancement

Office of the Vice President for International Affairs

Darsh T. Wasan
B.S., Ph.D.
Vice President

Mary Dawson
B.S.J.
Associate Vice President for International Affairs

Elizabeth Matthews
B.A., M.Ed.
Director of International Center

Office of Student Affairs

Katherine Murphy-Stetz
B.A., M.A.
Dean of Students

Erin Gray
B.S., M.S.
Director of Student Life

Daniel Kaplan
B.A., M.A., Ph.D.
Director of Counseling Center

Jennifer Luttig-Komrosky
B.A., M.Ed.
Director, Housing and Residential Services

Lynne Meyer
B.A., M.S.
Director of Spiritual Life

Lisa Montgomery
B.A.
Director, Office of Multicultural Student Services.

Kathleen Morgan
B.S., M.S.
Director, Clinical Services

Vickie Tolbert
Administration and Operations Manager

Office of Technology Services

Ophir Trigalo
B.A., B.S., M.B.A.
Chief Information Officer

Virginia Bentley
B.S.
Director, Telecommunications

Karen Fiorenza
B.A., M.B.A.
Director, Technology Support

Wesley Matthews
B.S., M.S.
Director, Enterprise Systems

James Meyer
B.S., M.S.
Associate Vice President, Project Management & Application Systems

Ibukun Oyewole
B.S., M.B.A.
Director, Technology Infastructure

Office of the Vice Provost for Undergraduate Admission and Financial Aid

Gerald P. Doyle
B.A., M.Ed.
Vice Provost for Undergraduate Admission and Financial Aid

Virginia Foster
B.S.
Director, Telecommunications

Catherine Fuller
Associate Director of Operations

Nareth Phin
B.A.
Assistant Director of Financial Aid

Jill Sifuentes
B.S., M.S.
Associate Director, Student Enrollment

Office of the Vice Provost for Undergraduate Affairs

Michael R. Gosz
B.S., M.S., Ph.D.
Vice Provost for Undergraduate Affairs

Matthew J. Bauer
B.S., M.S.
Director of Undergraduate Academic Advising

Eric Brey
B.S., M.Eng., Ph.D.
Director of Undergraduate Research

Thomas Jacobius
B.S., M.B.A.
Director of Interprofessional Studies and IPRO Program

John Leever
B.S.
Technical Business Analyst

Carole Orze
B.S.
Director of Undergraduate Academic Affairs

April Welch
B.S., B.A., M.S., M.A.
Communication Administrator

Peter Zachocki
B.A.
Registrar

School of Applied Technology

C. Robert Carlson
B.A., M.S., Ph.D.
Dean and Academic Director of Information Technology & Management Programs

Barbara Kozi
B.A.
Executive Assistant to the Dean

Maria Kozi-O'Donnell
B.A.
Director of Facilities and Special Programs

Tracy McGee
B.A., M.A.
International Program Manager, Professional Learning Programs

Scott Pfeiffer
B.A., M.B.A.
Director of Marketing and Development

Janet Reif
B.A., M.A.
Program Manager and Short Course Coordinator for Professional Learning Programs

Mazin Safar
B.S., M.S.C, M.B.A.
Interim Director of Industrial Technology & Management Programs

Pam Stella
B.A.
Director of Campus & Client Services, Daniel F. and Ada L. Rice Campus

Ray Trygstad
B.S., M.S.S.M.
Director of Information Technology and Associate Director of Information Technology & Management Programs

Carl Vizza
B.S., M.S.
Director of Professional Learning Programs

Lauren Wood
B.S., J.D.
Director of IIT Online

College of Architecture

Donna V. Robertson, FAIA
B.A., M.Arch.
Dean

Peter Beltemacchi
B.Arch., M.S.
Associate Dean

Timothy Brown
B.Arch. Director of International Affairs and Director of Graduate Admission

Matthew Cook
B.A., M.A., M.L.S.
Director of Research Resources

Kate Fitzgibbon
B.A.
Director for Graduate Academic Affairs

Michael Gillhouse
Assistant Materials Lab Manager

Rich Harkin
Media Services Coordinator

Faith Kancauski
Director of Administration and Financial Affairs

Robert Krawczyk
B.Arch. Director of Undergraduate Program

John Kriegshauser
B.A.
Model Shop Manager

Richard Nelson
B.A., M.Arch.
Director for Buildings and Operations

Sarah Pariseau
B.A., M.A.
Coordinator for Academic Affairs

R. Stephen Sennott
B.A., M.A.
Assistant Dean for Undergraduate Academic Affairs

Kimberly Soss
Architecture Librarian

Trevor Williams
Network and Systems Coordinator

Armour College of Engineering

Natacha de Paola
B.S., M.S., Ph.D.
Carol and Ed Kaplan Armour Dean of Engineering

Marilyn Birden
B.A., M.B.A.
Assistant Dean for Administrative and External Affairs

John S. Kallend
B.A., M.A., Ph.D.
Associate Dean of Accreditation and Assessment

Darci McHale
Assistant to the Dean, Budget and Graduate Affairs

David J. Mogul
B.S., M.S., Ph.D.
Interim Chair of Biomedical Engineering

Jamshid Mohammadi
B.S., M.S., Ph.D.
Chair of Civil and Architectural Engineering

Geoffrey Williamson
B.S., M.S., Ph.D.
Interim Chair of Electrical and Computer Engineering

Jamal S. Yagoobi
B.S., M.S., Ph.D.
Chair of Mechanical, Materials and Aerospace Engineering

Chicago-Kent College of Law

Harold J. Krent
A.B., J.D.
Dean

Jenna Abhijeet
B.A., M.S.Ed.
Director of Student Services

Tara L. Anderson
B.S., M.P.A.
Director of Alumni Relations

Lori B. Andrews
B.A., J.D.
Associate Vice President and Director of the Institute for Science, Law and Technology

Insa Blanke
J.D.
Director of Institutional Projects

Sarah K. Harding
B.A., LL.B., B.C.L., LL.M.
Associate Dean

Jeanne Kraft
B.S., M.S.
Assistant Dean for Career Services

Lydia Lazar
A.B., M.A., J.D.
Assistant Dean for International Law and Policy Development

Susan M. O'Brien
B.A., J.D.
Assistant Vice President for Communications

Dawn E. Rupcich
B.S.
Assistant Vice President for Administration, Finance, CLE/CPE, and the Center for Law and Computers

Jerry J. Seaton
Registrar; Director of Records and Exams

Francine Soliunas
B.S., J.D.
Assistant Dean for Strategy and Student Professional Development

Stephen D. Sowle
B.A., J.D.
Assistant Dean for Academic Administration and Student Affairs

Ronald W. Staudt
B.S., B.A., J.D.
Associate Vice President for Law, Business and Technology

Keith Ann Stiverson
B.S., M.S.L.S., J.D.
Director of the Downtown Campus Libraries

Elizabeth Turley
B.A., J.D.
Assistant Dean for Institutional Advancement

Nicole Vilches
B.A., M.S.Ed.
Assistant Dean for Admissions

Institute of Design

Patrick F. Whitney
B.F.A., M.F.A.
Dean

Jeremy Alexis
B.Arch, M.Des.
Assistant Dean

Hugh Musick
B.A., M.B.A., J.L.
Associate Dean

Graduate College

Ali Cinar
B.S., M.Eng., Ph.D.
Dean and Vice Provost for Research

Julia Chase
B.S., M.S.
Director, Communications for Graduate Affairs and Research

Morgan Frederick
B.A., M.A.
Deputy Director of Communications and Marketing

Deborah Gibson
B.S.
Director of Graduate and Professional Admission

Glenn Krell
B.A., M.P.A., C.R.A.
Director of Office of Research Compliance and Proposal Development

Sudhakar Nair
B.Sc., M.Eng., Ph.D.
Associate Dean for Academic Affairs

Domenica Pappas
B.S.
Director of Office of Sponsored Research and Programs

Holli Pryor-Harris
A.B., M.P.A.
Assistant Dean of Academic Affairs

Ganesh Raman
B.Tech., M.S., Ph.D.
Associate Dean for Research

Carlo Segre
B.S., M.S., Ph.D.
Associate Dean for Graduate Enrollment

Maya Suraj
B.A., M.P.A.
Deputy Director of Admissions and Special Projects

Baltazar Zamudio
B.S., B.S.
Director of Technical Services and Communications

Institute of Psychology

M. Ellen Mitchell
B.A., M.A., Ph.D.
Dean

Roya Ayman
B.A., M.A., Ph.D.
Division Head, Industrial Organization and Business Psychology

Patrick Corrigan
B.S., M.A., Ph.D.
Associate Dean for Research

Bruce M. Fisher
B.A., M.A., Ph.D
Director of the Center for Research and Service

Frank J. Lane
B.A., M.H.S., Ph.D.
Division Head, Rehabilitation Psychology

Scott B. Morris
B.A., Ph.D
Assistant Dean

Tamara Goldman Sher
B.A., M.A., Ph.D
Division Head, Clinical Psychology

College of Science and Letters

R. Russell Betts
B.S., M.A., M.S., Ph.D.
Dean

Grant Bunker
B.A., Ph.D.
Associate Chair of Physics

Maureen Flanagan
B.A., Ph.D.
Chair of Lewis Department of Humanities

Fred J. Hickernell
B.A., Ph.D.
Chair of Applied Mathematics

M. Ishaque Khan
B.S., M.S., Ph.D.
Associate Dean of Academic Affairs

Norman G. Lederman
B.S., M.S., Ph.D.
Chair of Mathematics and Science Education

Christina Nippert-Eng
B.A., M.A., Ph.D.
Interim Chair of Social Sciences

Benjamin Stark
B.S., M.Ph, Ph.D.
Associate Chair of Biology

Xian-He Sun
B.S., M.S., Ph.D.
Chair of Computer Science

Rong Wang
B.S., M.S., Ph.D.
Associate Chair of Chemistry

Vivian Weil
A.B., M.A., Ph.D.,
Director of Center for the Study of Ethics in the Professions

John F. Zasadzinski
B.S., Ph.D.
Associate Dean of Research

Stuart School of Business

Harvey Kahalas
B.S., M.B.A., Ph.D.
Dean

Thomas C. Anderson
B.S.B., M.S.
Associate Dean

Siva Balasubramanian
B.S., M.B.A., Ph.D.
Stuart Professor of Marketing and Associate Dean and Director of Undergraduate Programs

John Bilson
B.Econ., M.Econ., Ph.D.
Director of M.S. Finance Programs

Sanford A. Bredine
B.A., M.B.A.
Assistant Director, M.S. Marketing Communication Program

Krishna Erramilli
M.S., M.B.A., Ph.D.
Director of Graduate Business Programs

Eliezer Geisler
Ph.D.
Director, Center for Management of Medical Technology

J. Michael Gorhan
B.A., M.A., M.S., Ph.D.
Director, Center for Financial Markets

M. Zia Hassan
B.S., M.S., Ph.D.
Director of Ph.D. Program

Goerge P. Nassos
B.S., M.S., M.B.A., Ph.D.
Assistant Director, M.S. Environmental Management and Sustainability Program and Center for Sustainable Enterprise

Faculty Emeriti

William Applebaum
Associate Professor of History, 1972–1995

Ralph E. Armington
Professor of Electrical Engineering, 1966–1982

Robert Arzbaecher
Professor of Electrical Engineering and Director of the Pritzker Institute of Medical Engineering, 1981–2001

Charles R. Bauer
Associate Professor of Computer Science, 1985–1996

David R. Beam
Associate Professor of Political Science, 1987–2004

Barry Bernstein
Professor of Chemical Engineering and Applied Mathematics, 1966-2008

Robert John Bonthron
Professor of Mechanical and Aerospace Engineering 1947–1991

Fred P. Bosselman
Professor of Law 1991—-2003

Harold Walter Bretz
Associate Professor of Microbiology 1957–1986

Norman Nathan Breyer
Professor of Metallurgical and Materials Engineering 1964–1991

Ilene J. Burnstein
Associate Professor of Computer Science 1986–2003

Ray Aaron Burnstein
Professor of Physics 1965–2001

George D. Byrne
Professor of Applied Mathematics 1994–1998

Thomas Manuel Calero
Associate Professor of Management 1968–1993

Joseph San–Hoon Chung
Professor of Economics 1964–1995

Lew Collens
Professor of Law and President Emeritus, 1970-2009

William Frank Darsow
Associate Professor of Mathematics 1961–1990

John DeCicco
Professor of Mathematics, 1962–1976

Paul H. DeForest
Associate Professor of Political Science, 1969–2010

Rollin C. Dix
Professor of Mechanical Engineering 1964–2004

John Thomas Dygdon
Professor of Engineering Graphics, 1952–1996

Walter C. Eisenberg
Professor of Chemistry, 1987–2003

Thomas Erber
Distinguished Professor of Physics, 1957–2007

Joseph A. Erwin
Associate Professor of Biology 1967–2001

Martha Evens
Research Faculty of Computer Science 1975—-2000

Paul Edward Fanta
Professor of Chemistry 1948–1984

Susan Feinberg
Professor of English, 1980-2010

Robert Filler
Professor of Chemistry, 1955–1994

Maurice J. Frank, Jr.
Professor of Applied Mathematics 1976–2008

Glen O. Geist
Professor of Psychology, 1971–2003

Dmitri Gidaspow
Distinguished Professor of Chemical Engineering, 1962-2010

Lois Graham
Professor of Mechanical Engineering 1949–1985

Nicholas Grecz
Professor of Microbiology 1963–1982

Peter H. Greene
Research Professor of Computer Science 1974–2000

Sidney A. Guralnick
Perlstein Distinguished Professor of Engineering 1958–2004

Kevin P. Harrington
Professor of Architectural History 1978–2010

Boyd A. Hartley
Associate Professor of Fire Protection and Safety Engineering 1966–1985

Isidore Hauser
Professor of Physics, 1958–1986

Barbara R. Heller
Associate Professor of Applied Mathematics, 1980–2009

Geoffrey Trevor Higgins
Professor of Materials Engineering 1969–1998

Margaret H. Huyck
Professor of Psychology, 1969–2009

Robert Francis Irving
Associate Professor of English 1967–1995

Donald Komen Jasper
Professor of Biology 1969–1996

Porter W. Johnson
Professor of Physics, 1969–2008

Serope Kalpakjian
Professor of Mechanical and Materials Engineering 1963–2001

C. Jotin Khisty
Professor of Civil and Architectural Engineering 1990–2001

John W. Knowles
Professor of Management Science, 1969–2009

Willis George Labes
Professor of Fire Protection Engineering 1946–1979

Robert Joseph Malhiot
Professor of Physics 1956–1987

Fred R. McMorris
Professor of Applied Mathematics, 1999–2009

Mark Vladimir Morkovin
Professor of Mechanical Engineering 1967–1982

Charles L. Owen
Professor of Design, 1965–2010

H. Lennart Pearson
Associate Professor of Applied Mathematics and Dean of Graduate Studies
1954–1994

Robert William Porter
Professor of Mechanical and Aerospace Engineering
1966—-2001

Gregory Prygrocki
Associate Professor of Design,
1987–2009

Bernard Rasof
Professor of Mechanical Engineering
1964–1982

Robert Mark Roth
Professor of Biology
1968—-2003

Howard A. Rubin
Professor of Physics,
1966-2010

Gerald F. Saletta
Associate Professor of Electrical and Computer Engineering,
1962–2006

J. Robert Selman
Distinguished Professor of Chemical Engineering,
1975–2010

David C. Sharpe
Associate Professor of Architecture,
1962–2010

Jeffrey G. Sherman
Professor of Law,
1978–2010

Abe Sklar
Professor of Mathematics
1956–1995

Spencer B. Smith
Professor of Management Sciences and Industrial Management
1966–1996

Harold Norman Spector
Professor of Physics
1966–2001

Henry Stark
Professor of Electrical and Computer Engineering,
1988–2008

Edwin F. Steuben
Professor of Applied Mathematics,
1962–2006

San Utsunomiya
Associate Professor of Architecture
1966–1993

John Lawrence Way
Professor of Mechanical and Aerospace Engineering
1970–2001

Erwin Wilbur Weber
Associate Professor of Electrical and Computer Engineering
1961–1998

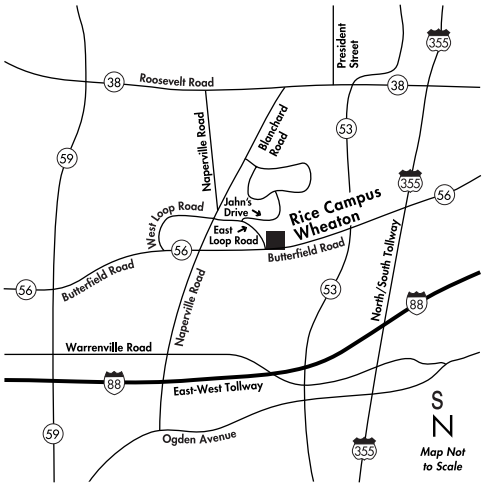
Dale Arroy Webster
Professor of Biology
1968–2001

Allen H. Wolach
Professor of Psychology,
1969–2007

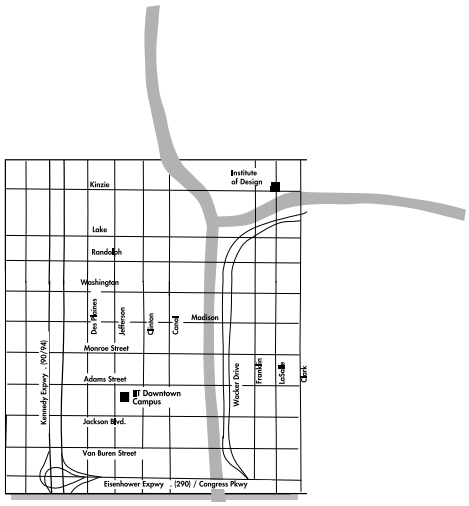
David Mordecai Zesmer
Professor of English
1962–1992

Earl Frederick Zwicker
Professor of Physics
1956–1991

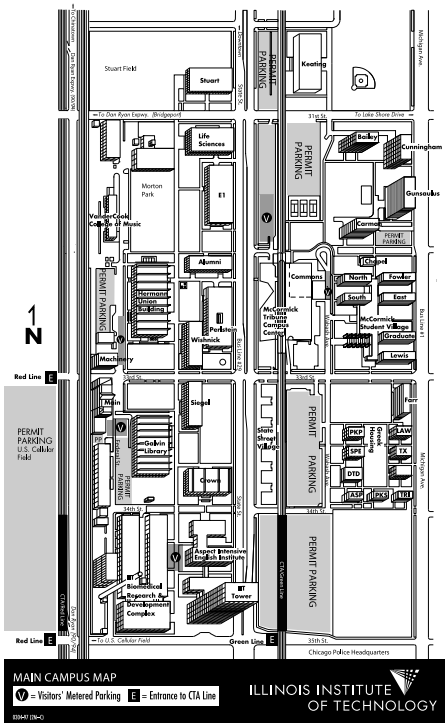
Rice Campus



Downtown Campus



Main Campus



Getting to Main Campus

Airports
IIT and Chicago are served by O'Hare International Airport and Midway Airport. Public and private transportation is available from the airports to downtown Chicago and IIT campuses.

Train
Commuter railroads to Union and Northwestern train stations (both off Canal Street), then public transportation, taxi or IIT shuttle bus from the Downtown Campus at 565 W. Adams Street to Main Campus.

Bus
To Greyhound terminal, then taxi or public transportation to IIT.

Public Transportation
1. CTA Red Line (Howard-Dan Ryan) to 35th Street Station.
2. CTA Green Line (Lake-Englewood-Jackson Park) to 35-Bronzeville-IIT station.
3. CTA bus lines with stops on State Street (#29) or Michigan Avenue (#35).

Automobile
From North: Dan Ryan Expressway east to 31st Street exit, continue south to 33rd Street, turn left (east) to just past State Street. Visitor parking is on the right (southeast corner). From South: Dan Ryan Expressway west to 35th Street exit, continue north to 33rd Street, turn right (east) to just past State Street. Visitor parking is on the right (southeast corner). From Lake Shore Drive: Exit at 31st Street, go inland (west) to State Street, turn left (south) to 33rd Street, turn left and visitor parking is on the right (southeast corner).

Parking
Some visitor parking is available in lots at the southeast corner of 33rd and State streets and the northeast corner of 31st and State streets. By special arrangement, events parking is usually available in the fraternity lot at 33rd and Wabash and, for evening events, in the lot west of Hermann Hall. A few hourly spaces are available just south of the Commons Building and west of Hermann Hall. Please call the Public Safety Department at 312.808.6300 if you need assistance in finding parking.

Faculty Index

A

Abbasian, Javad 128
Adams, Susan Johanne 148
Aderangi, Nader 129
Adler, Andre 58
Agam, Gady 178
Alexis, Jeremy 196
Anastasio, Mark 119, 207
Anderson, Paul 158
Anderson, Robert 129
Anderson, Thomas C. 316
Andrews, Lori B. 148
Anjali, Tricha 207
Arastoopour, Hamid 120, 128, 282
Arditi, David 158, 247
Arfanakis, Konstantinos 119
Argamon, Shlomo 178
Arzbaecher, Robert 119, 207
Atkin, Guillermo E. 207
Atuahene, Bernadette 148
Ayman, Roya 247, 300

B

Bach, Patricia 300
Bailey, Kimberly D. 148
Baker, Katharine K. 148
Balasubramanian, Siva 316
Bariff, Martin L. 316
Batlan, Felice 148
Bauer, Charles 178
Bauer, Matthew J. 346
Bekyarova, Tanya I. 93
Beltemacchi, Peter 73
Benedyk, Joseph C. 284
Berkaliev, Zaur 271
Betts, R. Russell 8
Betts, Russell 95
Bielecki, Tomasz 58
Bilgic, Mustafa 178
Bilson, John 316
Birdthistle, William A. 148
Bishnoi, Sandra Whaley 94
Bobco, William 247
Bonaccorsi, Richard 316
Borkar, Suresh 207
Bosselman, Fred Pl 148
Brackett, Robert E. 240
Brankov, Jovan G. 207
Bredine, Sanford A. 316
Brey, Eric M. 119
Brill, Ralph L. 148
Broadhead, Glenn J. 346
Brock, Thomas 73
Brody, Evelyn 148
Brown, Bartram S. 148
Brown, Gerald 148
Brown, Marshall 73
Brown, Timothy 73
Buccafusco, Christopher J. 148
Budiman, Jeffrey S. 158
Bunker, Grant 95
Burnstein, Ilene 178
Burnstein, Ray A. 95
Burton-Freeman, Britt 240

C

Cage, Brant 94
Calia, Roland 316
Calinescu, Gruia 178
Caltagirone, John 247
Cammino, Roberto 282
Cappozzo, Jack 240
Carlson, C. Robert 6, 178, 253
Cassel, Kevin W. 282
Cesarone, John C. 282
Chakravarti, Arjun 316
Chapman, Howard S. 148
Chaudoin, Greg 316
Cheng, Yu 207
Chlebus, Edward 178
Chmielewski, Donald J. 128
Cho, Sungjoon 148
Choi, Ken 207
Chong, Hyun-soon 94
Cialenco, Igor 58
Cigularov, Konstantin 300
Cinar, Ali 6, 119, 128
Clack, Herek L. 282
Coates, James 247
Collens, Lewis 148
Conger-Austin, Susan 73
Conviser, Richard J. 148
Cooper, Rick A. 316
Cork, Douglas J. 93
Corrigan, Patrick 300
Coyne, Daniel T. 148
Cramb, Alan W. 282
Cummings, Michael 93

D

Dabber, James 346
Davids, Carol 253
Davis, Blake 247
Davis, Michael 346
De Armond, Elizabeth 148
de Freitas, Rhonda E. 148
Decatorsmith, Jonathan P. 148
Denison, Dirk 73
DePaola, Natacha 7, 119
Donahue, John 247
Duan, Jinqiao 58
Dubrow, John 73
Durango-Cohen, Elizabeth J. 316
Dushay, Mitchell 93

E

Edelstein, Warren 58
Edirisinghe, Indika 240
Eglit, Howard C. 148
Ehrenberg, Suzanne 148
Eisenberg, Walter C. 94
Ellington, J. Kemp 300
Ellis, Robert 58
Elnimeiri, Mahjoub 73
Elrad, Tzilla 178
Emadi, Ali 207
Erber, Thomas 95
Erickson, David A. 148
Erramilli, Krishna 316
Evens, Martha 178

F

Fahnstrom, Dale 196
Fasshauer, Gregory 58
Feldy, Edmund 247
Felsen, Martin 73
Field, Jerry 247
Filler, Robert 94
Flanagan, Maureen 346
Flueck, Alexander J. 207
Flury, Frank 73
Foley, Robert 247
Footlik, Robert B. 247
Frankfurt, Vladimir 284
Frieder, Ophir 178
Friedman, Laurence 95

G

Gatchell, David 119
Geisler, Eliezer 316
Geist, Glen 300
Gerber, David J. 148
Gidalevitz, David 95
Gidaspow, Dimitri 128
Glodowski, Alan 95
Godfrey, Douglas Wm. 148
Goldberg, Joel 247
Goldhar, Joel 316
Gonzalez, Richard J. 148
Goodman, David 73
Gopal, Gurram 247
Gordon, Ruthanna 300
Gorham, Michael 316
Gosz, Michael R. 282
Greenberg, Sanford N. 148
Greene, Peter 178
Gregory, Judith 196
Grimes, John 196
Gross, Vivien C. 148
Grossman, David 178
Guralnick, Sidney A. 158

H

Hablutzel, Philip N. 148
Hamilton, Charles T. 316
Harding, Sarah K. 149
Harris, Edward C. 149
Harris, Geoffrey 316
Harris, Steven L. 149
Hassan, M. Zia 316
Hemphill, Libby 346
Heyman, Steven J. 149
Hickernell, Fred J. 58
Hock, Adam S. 94
Hoffman, Robert 247
Hood, Cynthia 178
Hood, Dennis 253
Hopkins, Joyce 300
Horn, Gerald 73
Hovey, David 73
Howard, Andrew 93
Hu, Zhiyong 284
Huyck, Margaret 300

I

Irving, Thomas C. 93, 119

J

Jain, Jagjit 247
Johnson, Kari L. 149
Johnson, Peter Y. 94
Johnson, Porter W. 95

K

Kahalas, Harvey 8, 316
Kallend, John S. 282
Kamper, Derek 119
Kang, Lulu 58
Kang-Mieler, Jennifer J. 119
Kaplan, Daniel 95
Kapoor, Sanjiv 178
Karidis, Chris 73
Karuri, Nancy W. 128
Kaul, Hemanshu 58
Kearns, Thomas 73
Keller, Sean 73
Kentra, Pamela 149
Khaligh, Alireza 207
Khalili, Nasrin R. 316
Khan, M. Ishaque 94
Khelashvili, Gocha 95
Khisty, C. Jotin 158
Kilbane, John 93
Kim, Joohee 207
Kimont, Jeffrey 253
Kling, Richard S. 149
Knowles, Robert H. 149
Knowles, Thomas W. 316
Koehler, Catherine M. 271
Korel, Bogdan 178
Kraus, Edward 149
Krawczyk, Robert 73
Krent, Harold J. 7, 149
Krishnamurthy, Kathiravan 240
Krishnamurthy, Mahesh 207
Krueck, Ron 73
Kuitermann, Eva 73
Kumar, Vijay 196
Kumiega, Andrew 247

L

Ladenson, Robert F. 346
Lam, Chow 300
Lan, Zhiling 178
Land, Peter 73
Lane, Frank 300
Larson, Jonathon 300
Laser, Gary S. 149
Leader, Laurie E. 149
Lederman, Judith S. 271
Lederman, Leon 95
Lederman, Norman G. 271
Lee, Alvin 240
Lee, Edward 149
Lee, Eun-Jeong 300
Lemming, Raymond 247
Levine, Marvin 247
Lewis, Philip 247
Li, Shuwang 58
Li, Xiang-Yang 178
Li, Xiaofan 58
Li, Zongzhi 158
Li, Zuyi 207
Lian, Jianwen (Jon) 316
Lidinsky, William 253
Lubin, Arthur 58
Lykos, Peter 94

M

Malin, Martin H. 149
Mallgrave, Harry Francis 73
Mandal, Braja K. 94
Mansy, Hansen 284
Marder, Nancy S. 149
Marzán, César F. Rosado 149
Maskanka, David 58
Mathew, Anijo 196
Maurer, William 247
McCormick, David L. 93
McLeish, Thomas J. 73
Mead, Alan 300
Meade, Kevin P. 282
Mehta, Rajendra 93
Menches, Cindy 158
Menhart, Nick 93
Meyer, Daniel Z. 271
Miller, Jonathan 73
Mitchell, M. Ellen 8, 300
Modares, Mehdi 158
Mogul, David 119
Mohammadi, Jamshid 158
Morris, Scott 300
Morrison, Timothy 95
Moschandreas, Demetrios J. 158
Mostovoy, Sheldon 282
Muehleisen, Ralph T. 158
Mueller, Suzanne 317
Murillo, Genoveva 93

N

Nagib, Hassan M. 282
Nagle, Kathleen 73
Nahmod, Sheldon H. 149
Nair, Sudhakar E. 58, 283
Nash, Philip G. 283
Nassos, George P. 317
Nelson, Richard 73
Nemeth, Christopher 247
Nguyen, Diep 94
Nieswandt, Martina 271
Nikolov, Alex 129

Noll, Kenneth E. 158
Norton, Terrance A. 149
Novak, James 158

O

O'Leary, John R. 158
Ong, Michael K. 317
Orgel, Joseph 93
Oruklu, Erdal 207
Osler, Peter L. 73
Ostrogorsky, Aleksandar 283
Otterbacher, Jahna 346
Owen, Charles 196

P

Pagilla, Krishna 158
Papavasiliou, Georgia 119
Parulekar, Satish 128
Peet, Matthew 283
Pelsmajer, Michael J. 59
Peluso, Alphonso 73
Perez-Luna, Victor 120
Perez-Luna, Victor H. 128
Perritt, Henry H. 149
Pervan, Boris 283
Peters, Scott 317
Pettigrew, Paul 73
Piatt, Mickie A. 149
Plomp, Bert 129
Potts, Natalie Brouwer 149
Power, Margaret 346
Prakash, Jai 128
Prendergast, John 247
Pulliam, Gregory J. 346

Q

Qian, Xiaoping 283

R

RAicu, Ioan 178
Raman, Ganesh 283
Ramani, Vijay K. 128
Reingold, Edward M. 59, 178
Rempfer, Dietmar 59, 283
Ren, Kui 207
Ren, Shangping 178
Riley, Benjamin R. 74
Riley, Kathryn 346
Robertson, Donna 7
Robertson, Donna V. 74
Rockey, Christopher 74
Roesch, Peter 74
Ronan, John 74
Rosen, Mark D. 149
Rozansky, Irene 247
Rubin, Howard A. 95
Rudstein, David S. 149
Ruiz, Francisco 283

S

Sabbaghi, Navid 317
Safar, Mazin 247
Saletta, Gerald F. 207
Saniie, Jafar 207
Sato, Keiichi 196
Scarlatta, Valerie 253
Schachman, Andrew 74
Schell, Rich 240
Schieber, Jay D. 128
Schipporeit, George 74
Schleser, Robert 300
Schmaus, Warren S. 346
Schmidt, Christopher W. 149
Schug, Kenneth 94
Schwartz, David L. 149
Sciammarella, Cesar A. 284
Scodro, Michael A. 149
Scott, H. Larry 95
Seaman, Christopher B. 149
Segre, Carlo U. 95
Selman, J. Robert 129
Shadden, Shawn 283
Shahidehpour, Mohammad 207
Shanechi, Hassan 207
Shankar, Rama 247
Shapiro, Carolyn 149
Shen, Jay H. 158
Sher, Tamara Goldman 300
Sherman, Jeffrey G. 149
Shields, Herb 247
Siddiqi, Muhammad 247
Sitton, Susan S. 59
Snapper, John W. 346
Snyder, Mark E. 158
Sowle, Stephen D. 149
Spak, Michael I. 149
Spector, Harold N. 95
Spenko, Matthew 283
Spentzouris, Linda Klamp 95
Spink, Kathryn M. 93
Stark, Benjamin C. 93
Stark, Henry 207
Staudt, Ronald W. 149
Steinman, Joan E. 150
Stern, Stephanie M. 150
Stetter, Joseph R. 94
Stewart, Cynthia 93
Stewart, Margaret G. 150
Stiverson, Keith Ann 150
Stolley, Karl A. 346
Streseman, Kent 150
Strubbe, Mary Rose 150
Stutzki, Christian 74
Sud, Prem 248
Sullivan, Zack 95
Sun, Joing 317
Sun, Xian-He 179
Sun, Yang-Kook 129

T

Takeuchi, Arthur 74
Tarlock, A. Dan 150
Terry, Jeff 95
Teymour, Fouad 120
Teymour, Fouad A. 128
Thomopoulos, Nick T. 317
Tier, Charles 59
Tijunelis, Donatas 248
Tin, Sammy 283
Tomal, Daniel 248
Torun, Yagmur 95
Tourk, Khairy A. 317
Troyk, Philip R. 119
Trygstad, Raymond E. 253
Turitto, Vincent 120
Twombly, John 248
Twombly, John R. 317

U

Unni, Aditya K. 94

V

Van Vliet, Benjamin 317
Varma, Sameer 94
Venerus, David C. 128
Vural, Murat 283

W

Wagman, Liad 317
Wan, Jason 93, 240
Wan, Peng-Jun 179
Wang, Haizhi 317
Wang, Jia 207
Wang, Rong 94
Wark, Candace E. 283
Warner, Richard 150
Wasan, Darsh 240
Wasan, Darsh T. 128
Weber, Erwin W. 208
Webster, Dale A. 93
Wernick, Miles 120, 208
Wetzek, Cathering 74
White, Christopher 95
Whitney, Patrick F. 7, 196
Whitney, Stephanie R. 271
Williams, David R. 283
Williamson, Geoffrey 208
Wolach, Allen 300
Wood, Anthony 74
Wright, Richard W. 150
Wu, Benxin 283
Wu, Tao 317

X

Xiang, Jialing 93
Xu, Yang 208

Y

Yagoobi, Jamal S. 283
Yang, Yongyi 120, 208
Yee, Wai Gen 179
Yetik, Imam Samil 208
Young, Michael 300
Young, Thomas T. Y. 208

Z

Zasadzinski, John 95
Zawojewski, Judith S. 271
Zeng, Lulu 317
Zhang, Chunbo 93
Zhang, Hong 179
Zhang, Wei 93, 240
Zhou, Chi 208
Zwicker, Earl 95

A

Academic Grades 39
Academic Policies for Continuation of Studies 37
Academic Probation 37
Academic Resource Center 11
Accelerator and Particle Physics, Center for 15
Access, Card, and Parking Services 11
Accreditation 6
Administration 359
Admission Procedures 29
Admission Requirements
  Applied Mathematics 59
  Architectural Engineering 159
  Architecture 75
  Biological Engineering 130
  Biology 96
  Biomedical Engineering 120
  Business 317
  Chemical Engineering 130
  Chemistry 96
  Civil Engineering 159
  Computer Engineering 209
  Computer Science 180
  Design 196
  Electrical Engineering 209
  Energy, Environment, Economics $\mathbf{E^3}$ 235
  Environmental Engineering 159
  Food Safety and Technology 241
  Information Technology and Management 254
  Law 151
  Mathematics Education 272
  Mechanical, Materials and Aerospace Engineering 285
  Physics 96
  Psychology 301
  Science Education 272
  Technical Communication 347
Alumni Tuition Benefit (ALUMED) 54
Apartment Housing 51
Appeal by Petition 48
Application for Admission 29
Application for Graduation 45
Applied Mathematics, Dept. of 56
  address 56
  admission requirements 59
  Collegiate Mathematics Education 62
  course descriptions 63
  degrees offered 56
  Doctor of Philosophy 62
  faculty 58
  Master of Mathematical Finance 60
  Master of Science 61
  research and program areas 56
  research facilities 56
Applied Technology, School of 69
  address 69
  certificate program details 260
  certificate programs 70
  course descriptions 263
  degrees offered 69
  IIT online 70
  Master of Information Technology & Management 255
  professional learning programs 70
Appointment with Thesis Examiner 47
Architecture, Coll. of 71
  accreditation 71
  address 71
  admission requirements 75
  course descriptions 85
  degrees offered 72
  Doctor of Philosophy 84
  faculty 73
  M.S. Architure 79
  Master of Architecture with Advanced Standing 76
  Master of Architecture, Professional 76
  Master of Integrated Building Delivery 81
  Master of Landscape Architecture 82
  mission 71
  research areas 72
  research facilities 72
Armour College of Engineering 7
Athletics and Recreation 11
Audit 40

B

Biological, Chemical and Physical Sciences, Dept. of 92
  address 92
  admission requirements 96
  Biology 97
  certificate program details 110
  certificate programs 92
  Chemistry 104
  course descriptions 112
  degrees offered 92
  faculty 93
  graduate examinations 96
  Physics 108
  research centers 92
  research facilities 92
Biology
  course descriptions 112
  Doctor of Philosophy in Biology 101
  Doctor of Philosophy in MBB 103
  faculty 93
  Master of Biology 97
  Master of Science 98
  Master of Science in MBB 102
  Molecular Biochemistry and Biophysics (MBB) 102
  specializations 98
Biomedical Engineering, Dept. of 119
  address 119
  admission requirements 120
  affiliated faculty 120
  course descriptions 123
  degree 119
  Doctor of Philosophy 121
  faculty 119
  research areas 119
Board of Trustees 357
Business, Stuart School of 313
  address 313
  admission requirements 317
  B.S./M.P.A. 329
  business at IIT 313
  certificate program details 324
  certificate programs 314
  course descriptions 330
  degrees offered 313
  Doctor of Philosophy in Management Science 325
  dual degree programs 314
  faculty 316
  graduate programs 317
  J.D./M.P.A. 329
  J.D./M.S. in Environmental Management and Sustainability 329
  M.B.A./M.P.A. 328, 329
  M.B.A./M.S. in Environmental Management and Sustainability 328
  M.B.A./M.S. in Marketing Communication 328
  M.Des./M.B.A. 328
  M.S. in Environmental Management and Sustainability 318
  M.S. in Finance 319
  M.S. in Marketing Communication 321
  M.S. in Mathematical Finance 320
  Master of Business Administration 318
  Master of Public Administration 321
  Master of Public Administration specializations 323
  research facilities 315

C

Campus Resources 11
  Academic Resource Center 11
  Access, Card, and Parking Services 11
  Athletics and Recreation 11
  Career Management Center 11
  Communication Across the Curriculum Program 11
  Commuter Student Services 12
  Cooperative Education Program 12
  Disability Resources 12
  International Center 12
  Interprofessional Projects 13
  Multicultural Student Services 13
  Parking 11
Career Management Center 11
Center for the Study of Ethics in the Professions (CSEP) Library 14
Certificate Programs 46
Change of Grade 40
Change of Master's Thesis to Non-Thesis Option 46
Change of Records 48
Change of Registration 35
Chemical and Biological Engineering, Dept. of 126
  address 126
  admission requirements 130
  certificate program details 137
  certificate programs 126
  course descriptions 139
  degrees offered 126
  Doctor of Philosophy 136
  dual-degrees 126
  faculty 128
  interdisciplinary programs 126
  M.S. in Chemical Engineering 133
  M.S. in Computer Science/Master of Chemical Engineering 133
  M.S. in Food Process Engineering 134
  Master of Biological Engineering 131
  Master of Chemical Engineering 131
  Master of Food Process Engineering 132
  research areas 127
  research centers 127
  research facilities 127
Chemistry
  course descriptions 114
  Doctor of Philosophy 107
  faculty 94
  Master of Chemistry 105
  Master of Chemistry in Materials and Chemical Synthesis 106
  Master of Chemistry in Analytical Chemistry 104
  Master of Science 106
Chicago and its Environs 9
Chicago-Kent College of Law 7
Civil, Architectural and Environmental Engineering, Dept. of 156
  address 156
  admission requirements 159
  Bachelor of Architecture/Master of Architectural Engineering 164
  Bachelor of Architecture/Master of Construction Engineering and Management 164
  Bachelor of Architecture/Master of Structural Engineering 164
  certificate program details 165
  certificate programs 156
  combined degrees 156
  course descriptions 167
  degrees offered 156
  Doctor of Philosophy in Civil Engineering 163
  Doctor of Philosophy in Environmental Engineering 164
  faculty 158
  Master of Architectural Engineering 160

Master of Construction Engineering and Management 160
Master of Environmental Engineering 162
Master of Geoenvironmental Engineering 160
Master of Geotechnical Engineering 160
Master of Public Works 162
Master of Science in Civil Engineering 162
Master of Science in Environmental Engineering 163
Master of Structural Engineering 160
Master of Transportation Engineering 160
research areas 157
research facilities 157
Class Attendance 41
Code of Academic Honesty 48
College of Architecture 7
College of Science and Letters 8
Colleges and Schools 6
Chicago-Kent College of Law 145
College of Architecture 71
Institute of Psychology 299
Instutute of Design 195
School of Applied Technology 69
Communication Across the Curriculum Program 11
Commuter Student Services 12
Completion of Studies and Graduation 45
Complex Systems and Dynamics, Center for 15
Computer Science, Dept. of 177
address 177
admission requirements 180
certificate program details 188
certificate programs 177
course descriptions 189
degree specializations 182
degrees offered 177
Doctor of Philosophy 185
faculty 178
joint and dual degrees 177
M.S. in Computer Science/Master of Chemical Engineering 181
Master of Computer Science 181
Master of Science 183
Master of Science for Teachers 183
Master of Telecommunications and Software Engineering 184
research areas 177
research facilities 177
Cooperative Education Program 12
Counseling Services 23
Course Descriptions
Architecture (ARCH) 85
Biology (BIOL) 112
Biomedical Engineering (BME) 123
Business Administration (MBA) 334
Chemical and Biological Enineering (CHE) 139
Chemistry (CHEM) 114
Civil and Architectural Engineering (CAE) 167
Computer Science (CS) 189
Design (ID) 200
Economics (ECON) 330
Electrical and Computer Engineering (ECE) 227
Environmental Engineering (ENVE) 174
Environmental Management (EM) 330
Food Process Enineering (FPE) 143
Food Safety and Technology (FST) 245
Industrial Technology and Management (INTM) 251
Information Technology and Management (ITM) 263
Management Science (MSC) 338
Marketing Communication (MC) 336
Mathematical Finance (MSF) 331
Mathematics (MATH) 63
Mathematics and Science Education (MSED) 277
Mechanical, Materials and Aerospace Engineering (MMAE) 292
Physics (PHYS) 117
Psychology (PSYC) 307
Public Administration (PA) 339
Technical Communication (COM) 353
Course Numbering 34
Course Substitution 38
Credit by Examination 38
Credit Requirements 37
Crisis Services 23

D

Dean's Scholarship 54
Demographics 9
Departments
Applied Mathematics 56
Biological, Chemical and Physical Sciences 92
Biomedical Engineering 119
Chemical and Biological Engineering 126
Civil, Architectural and Environmental Engineering 156
Computer Science 177
Design, Institute of 195
address 195
admission requirements 196
course descriptions 200
degrees offered 195
Doctor of Philosophy 199
faculty 196
Master of Design 197
Master of Design Methods 198
Master of Design/ M.B.A. 198
research areas 195
research facilities 195
Diabetes Research and Policy, Center for 15
Directions to Campus 369
Disability Resources 12
Doctoral Degrees 24
Downtown Campus Library 14

E

Electric Power and Power Electronics Center 17
Electrical and Computer Engineering, Dept. of 205
address 205
admission requirements 209
certificate program details 223
certificate programs 205
course descriptions 227
degrees offered 205
Doctor of Philosophy in Computer Engineering 222
Doctor of Philosophy in Electrical Engineering 222
faculty 207
interdisciplinary programs 205
joint degrees 205
M.S. in Computer and Electrical Engineering 214
M.S. in Computer Engineering 212
M.S. in Electrical Engineering 210
Master of Biomedical Imaging and Signals 216
Master of Computer and Electrical Engineering 215
Master of Electricity Markets 221
Master of Network Engineering 219
Master of Power Engineering 217
Master of Telecommunications and Software Engineering 220
Master of VLSI and Microelectronics 218
research areas 206
research centers and facilities 206
Electrochemical Science and Engineering, Center for 15
Employment 54
Energy +Power Center 17
Energy, Environment , Economics $\mathbf{E^3}$
program description 234
Energy, Environment, Economics $\mathbf{E^3}$ 234
admission requirements 235
course descriptions 237
degrees offered 234
Doctor of Philosophy with $\mathbf{E^3}$ specializaion 237
M.S. in Chemical Engineering with $\mathbf{E^3}$ specializaion 235
M.S. in Electrical Engineering with $\mathbf{E^3}$ specializaion 237
M.S. in Environmental Engineering with $\mathbf{E^3}$ specializaion 236
M.S. in Mechanical and Aerospace Engineering with $\mathbf{E^3}$ specializaion 236
Master of Chemical Engineering with $\mathbf{E^3}$ specializaion 235
Master of Electrical and Computer Engineering with $\mathbf{E^3}$ specializaion 236
Master of Environmental Engineering with $\mathbf{E^3}$ specializaion 235
Master of Mechanical and Aerospace Engineering with $\mathbf{E^3}$ specializaion 236
research centers and facilities 234
Energy/Environment/Economics (E^3) 20
Engineering Center For Diabetes Research and Education 17
Enrollment Confirmation and Deferral Requests 33
Examinations 42
Comprehensive 43
Doctoral 42
Final Thesis 44
Master's Comprehensive 42
Master's Thesis 42
Excellence in Polymer Science and Engineering, Center of 15
Expenses and Financial Assistance 49

F

Faculty Emeriti 366
Financial Aid 52
Fluid Dynamics Research Center 17
Food Safety and Technology 239
address 239
admission requirements 241
certificate program details 244
certificate programs 239
course descriptions 245
degrees offered 239
facilities 239
faculty 240
M.S. Food Safety and Technology 242
Master of Food Safety and Technology 243

G

General Policies 48
Grade Point Average 37
Graduate Accelerated Courses 46
Graduate Certificate Programs 25
Graduate College 6

Graduate Degree Programs and General Requirements 24
Grainger Power Engineering Laboratory 20

H

Health Center 21
Health Insurance 50
High Performance Computing Center 17
History and Campuses 9
Housing 51

I

IIT Research Institute 18
Immunization Requirement 33
Incomplete ("I") Grades 39
Industrial Technology and Management
address 246
course descriptions 251
degree offered 246
faculty 247
Master of Industrial Technology and Operations 249
Inernational Applican t Requirements 31
Information Technology and Management 253
address 253
admission requirements 254
certificate programs 253
degree offered 253
faculty 253
labs and research centers 254
Institute for Science, Law & Technology 20
Institute of Design 7
Institute of Psychology 8
Integrative Neuroscience and Neuroengineering Research, Center for 15
Intellectual Property and Technology Transfer 20
Intellectual Property Management and Markets 270
degree offered 270
degree requirements 270
International Center 12
International Center for Sensor Science and Engineering 18
International Center for Sustainable New Cities 18
Interprofessional Projects 13
Invention Center 20
IPRO Registration 35

L

Law Degrees 24
Law, Chicago-Kent College of 145
address 145
admission requirements 151
certificate program details 153
certificate programs 145
computer facilities 147
courses 155
degrees offered 145
faculty 148
J.D./LL.M. in Family Law 151
J.D./LL.M. in Financial Services Law 151
J.D./LL.M. Taxation 151
J.D./M.B.A. 152
J.D./M.P.A. 152
J.D./M.P.H. 152
J.D./M.S. in Environmental Management and Sustainability 152
J.D./M.S. in Finance 152
Juris Doctor 151
Master of Laws 151
research and clinical training areas 147
research and training facilities 147
research centers 145
trial advocacy 155
Leave of Absence 37
Letter of Completion 47
Libraries 14
Louis W. Biegler Library 14

M

Management of Medical Technology, Center for the 15
Manufacturing Productivity Center 20
Manufacturing Productivity Center (MPC) 16
Maps 368
Master of Science Degrees 24
Mathematical Finance 60
Mathematics and Science Education, dept. of 271
address 271
admission requirements 272
course descriptions 277
degrees offered 271
Doctor of Philosophy in Collegiate Mathematics Education 276
Doctor of Philosophy in Mathematics Education 274
Doctor of Philosophy in Science Education 275
faculty 271
M.S. in Mathematics Education 272
M.S. in Science Education 273
Master of Mathematics Education 272
Master of Science Education 273
research areas 271
teacher certification 273
Mechanical, Materials and Aerospace Engineering, Dept. of 281
address 281
admissions 285
certificate program details 291
certificate programs 281
course descriptions 292
degrees offered 281
Doctor of Philosophy in Materials Science and Engineering 290
Doctor of Philosophy in Mechanical and Aerospace Engineering 290
faculty 282
interdisciplinary programs 281
M.S. in Manufacturing Engineering 288
M.S. in Materials Science and Engineering 288
M.S. in Mechanical and Aerospace Engineering 288
Master of Manufacturing Engineering 286
Master of Manufacturing Engineering via Internet 287
Master of Materials Science and Engineering 286
Master of Mechanical and Aerospace Engineering 286
research areas 282
research centers 281
research faculty 284
resesarch facilities 281
Medical Imaging Research Center 18
Molecular Study of Soft Condensed Matter, Center for the 16
Multicultural Student Services 13

N

National Center for Food Safety & Technology Library 14
National Center for Food Safety and Technology 19
Newly Admitted Students 33
Non-Attendance "NG" Grade 39

O

Objective of Education 6
Online Receiving Sites 10

P

Parking 11
Parking Fee 50
Paul V. Galvin Library 14
Physics
course descriptions 117
Doctor of Philosophy 109
faculty 95
Master of Health Physics 108
Master of Science 108
Post-Baccalaureate (UPB) Students 33
Pritzker Institute of Biomedical Science and Engineering 19
Professional Master's Degree 45
Professional Master's Degrees 25
Program of Study 38
Psychology, Institute of 299
address 299
admission requirements 301
B.S. in Psychology/M.S. in Personnel and Human Resources Development 305
B.S. in Psychology/ M.S. in Rehabilitation 306
certificate program details 306
combined degree programs 299
course descriptions 307
degrees offered 299
Doctor of Philosophy 304
faculty 300
fellowships 305
M.S. in Personnel and Human Resources Development 302
M.S. in Psychology 302
M.S. in Rehabilitation Counseling 303
program descriptions 301
research areas 299
research centers 299
research facilities 299

R

Readmission for a Second Graduate Degree 32
Registration 34
Registration for T.A. Seminar 35
Reinstatement and Enrollment After an Absence 37
Repeating a Course 40
Research Centers 15
Residence and Greek Life 20
Residence Halls 51
Residence Requirement 40

S

Satisfactory Grades 40
School of Applied Technology 6
Service, Education, and Outreach Centers 20
Spiritual Life 21
Standards of Conduct 48
Strategic Competitiveness, Center for 16
Stuart School of Business 8
Student Activities 21
Student Affairs 21
Study of Ethics in the Professions, Center for the 16
Synchrotron Radiation Research and Instrumentation, Center for 17
Synopsis of Graduate Studies 27

T

Technical Communication 345
address 345
admission requirements 347
certificate program details 352
certificate programs 345
course descriptions 353
degrees offered 345
Doctor of Philisophy in Technical Communication 350
faculty 346
M.S. in Information Architecture 349
M.S. in Technical Communication and Information Design 348
research areas 345
research facilities 345
Technology Commercialization 21
Technology Services 22
Temporary Off-Campus Housing 52
Thermal Processing Technology Center 19
Thesis Preparation Meeting 46

Time Limit to Complete a Degree 41
Transcript of Grades 47
Transfer Credits 38
Transferring from Another Program 38

U

Undergraduates Registering for Graduate Courses 36
University Refund Policy 50
Unsatisfactory Grades 40

V

Veterans' Educational Benefits 54

W

Wanger Institute for Sustainable Energy Research 19
Wireless Network and Communications Research Center 19
Withdraw Failing 40
Withdraw Passing 40
Withdrawal from the University 36
Women's Services 22
Work Zone Safety and Mobility, Center for 17
Writing Centers 22