SCHOOL OF COMPUTER

SCIENCE, TELECOMMUNICATIONS

AND INFORMATION SYSTEMS
SCHOOL OF COMPUTER SCIENCE, TELECOMMUNICATIONS AND INFORMATION SYSTEMS

ADMINISTRATION

HELMUT EPP, PH.D.
Dean
GREGORY BREWSTER, PH.D.
Associate Dean
MARTIN KALIN, PH.D.
Associate Dean
LINDA V. KNIGHT, PH.D.
Associate Dean
DAVID MILLER, PH.D.
Associate Dean
ANNE B. MORLEY
Assistant Dean
TERRY SKWAREK
Director, Institute for Professional Development
Assistant Dean

FACILITIES
FACULTY
ADMISSION
ACADEMIC PROGRAMS

BACHELOR OF SCIENCE IN COMPUTER GAMES DEVELOPMENT

BACHELOR OF SCIENCE IN COMPUTER GRAPHICS AND ANIMATION
   I. Developer
   II. Technical Designer

BACHELOR OF SCIENCE IN COMPUTER SCIENCE
   I. Computer Science Concentration
   II. Honors in Software Engineering

BACHELOR OF ARTS AND BACHELOR OF SCIENCE IN DIGITAL CINEMA

BACHELOR OF SCIENCE IN E-COMMERCE TECHNOLOGY

BACHELOR OF SCIENCE IN HUMAN-COMPUTER INTERACTION

BACHELOR OF SCIENCE IN INFORMATION ASSURANCE ENGINEERING

BACHELOR OF SCIENCE IN INFORMATION SYSTEMS

BACHELOR OF ARTS AND BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

BACHELOR OF SCIENCE IN MATHEMATIC AND COMPUTER SCIENCE
   I. Theory
   II. Computational Methods
   III. Graphics
   IV. Artificial Intelligence
   V. Data Analysis

BACHELOR OF SCIENCE IN NETWORK TECHNOLOGY
   I. Standard
   II. Network Security
COMBINED BACHELOR OF SCIENCE AND MASTER OF SCIENCE DEGREES

I. BS/MS in Computer Science
II. BS/MS in Network and Telecommunications
III. BS in Math/Computer Science and MS in Computer Science
IV. BS in Computer Science and MS in Software Engineering
V. BS in Computer Science – Software Engineering Honors Concentration and MS in Software Engineering
VI. BS IS / MS CINS – Information Systems Security track
VII. BS CS / MS CINS – Computer Security track
VIII. BS MATH-CS / MS CINS – Computer Security track
IX. BS NT / MS CINS – Network Security track
X. BS in Computer Science and MS in Distributed Systems
XI. BS in Math/Computer Science and MS in Distributed Systems

BACHELOR OF ARTS IN COMPUTING (JOINT DEGREE WITH SCHOOL OF NEW LEARNING)

SPECIAL PROGRAM: TEACHER OF COMPUTER SCIENCE: SECONDARY LEVEL

MINORS

COURSES

GENERAL INFORMATION

The School of Computer Science, Telecommunications and Information Systems offers a course of studies leading to the degrees of Bachelor of Science in Computer Graphics and Animation, Bachelor of Science in Computer Science, Bachelor of Science in E-Commerce Technology, Bachelor of Science in Information Systems, Bachelor of Science in Human-Computer Interaction, Bachelor of Science in Math and Computer Science, Bachelor of Science in Network Technology and Bachelor of Arts in Computing. The purpose of each curriculum is to prepare the student with the requisite theoretical, technical, and practical knowledge for a professional career in various computer or computer-related fields. Each degree program develops an informed view of the relationship between computer science and its allied fields while equipping the student with the technical expertise necessary to enter a computer-related career.

FACILITIES

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

The School itself operates specialized laboratories in the following:

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

HELMUT EPP, PH.D.,
Professor and Dean
Northwestern University

HANI ABU-SALEM, PH.D.,
Associate Professor
Illinois Institute of Technology

OLAYELE ADELAJUN, PH.D.,
Assistant Professor
Turku School of Economics & Business Adm.

EHAB AL-SHAER, PH.D.,
Associate Professor
Old Dominican University

GARY ANDRUS, PH.D.,
Associate Professor
Wayne State University

DAVID ANGULO, M.S.,
Instructor
Loyola University Chicago

ANDRÉ BERTHIAUME, PH.D.,
Associate Professor
University of Montreal

GIAN MARIO BESANA, PH.D.,
Associate Professor
University of Notre Dame

GREGORY BREWSTER, PH.D.,
Associate Professor and Associate Dean
University of Wisconsin, Madison

JACEK BRZEZINSKI, PH.D.,
Assistant Professor
DePaul University

ROBIN BURKE, PH.D.,
Associate Professor
Northwestern University

ALAN BURNS, PH.D.,
Assistant Professor
Kent State University

SUSY CHAN, PH.D.,
Professor
Syracuse University

I-PING CHU, PH.D.,
Associate Professor
State University of New York at Stony Brook

ANTHONY CHUNG, PH.D.,
Associate Professor
University of Maryland Baltimore County
KAMAL DAHBUR, PH.D.
Assistant Professor
DePaul University

LUCIA DETTORI, PH.D.,
Assistant Professor
University of Paris XI

MASSIMO DIPIERRO, PH.D.,
Assistant Professor
University of Southampton, UK

CLARK ELLIOTT, PH.D.,
Associate Professor
Northwestern University

KHALED EL-ZAYYAT, PH.D.,
Associate Professor
University of Reno

SCOTT ERLINDER, MFA
Assistant Professor
Columbia College

XIAOWEN FANG, PH.D.,
Assistant Professor
Purdue University

ROBERT FISHER, PH.D.,
Associate Professor
Harvard University

JACOB FURST, PH.D.,
Associate Professor
University of North Carolina at Chapel Hill

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

JANE HUANG, PH.D.,
Assistant Professor
University of Illinois at Chicago

LOUIS IBARRA, PH.D.,
Assistant Professor
University of Victoria

MATT IRVINE, MFA,
Assistant Professor
Columbia College

RADHA JAGADEESAN, PH.D.,
Professor
Cornell University

ALAN JEFFREY, PH.D.,
Associate Professor
University of Oxford
DANIEL MITTLEMAN, PH.D.,
Associate Professor
The University of Arizona

BAMSHAD MOBASHER, PH.D.,
Associate Professor
Iowa State University

JAMI MONTGOMERY, PH.D.,
Assistant Professor
Illinois Institute of Technology

ASHLEY MORRIS, PH.D.,
Associate Professor
Tulane University

THOMAS MUSCARELLO, PH.D.,
Associate Professor
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MAKOTO NAKAYAMA, PH.D.,
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University of California, Los Angeles

GARY NOVAK, MFA
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American Film Institute

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Carnegie Mellon University

JOSEPH PHILLIPS, PH.D.,
Assistant Professor
University of Michigan

CORIN PITCHER, PH.D.,
Assistant Professor
University of Oxford

DANIELA RAICU, PH.D.,
Assistant Professor
Oakland University

JAMES RIELY, PH.D.,
Assistant Professor
University of North Carolina at Chapel Hill

JOHN ROGERS, PH.D.,
Associate Professor
University of Chicago

MARCUS SCHAEFER, PH.D.,
Assistant Professor
University of Chicago

ERIC SCHWABE, PH.D.,
Associate Professor
Massachusetts Institute of Technology
ERIC SEDGWICK, PH.D.,
Associate Professor
University of Texas

RAFFAELLA SETTIMI, PH.D.,
Assistant Professor
University of Perugia

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

PAUL SISUL, M.DIV.,
Instructor
DeAndreis Institute of Theology

ADAM STEELE, PH.D.,
Assistant Professor
Concordia University

DAVID STONE, BFA
Assistant Professor
Cornell University

THERESA STEINBACH, M.B.A., M.S.,
Instructor
DePaul University

HAROLD STREETER, M.S.,
Instructor
Brown University

NORMA SUTCLIFFE, PH.D.,
Assistant Professor
University of California at Los Angeles

NORIKO TOMURO, PH.D.,
Assistant Professor
DePaul University

CURT WHITE, PH.D.,
Associate Professor
Wayne State University

PETER WIEMER- HASTINGS, PH.D.,
Assistant Professor
University of Michigan, Ann Arbor

CHARLES WILCOX, B.A.,
Instructor
Southern Illinois University

ROSALIE WOLFE, PH.D.,
Professor
Indiana University

YONGHE YAN, PH.D.,
Assistant Professor
The University of Hong Kong
ADMISSION
Candidates interested in admission to the school should direct all inquiries to the Office of admission, DePaul University, 1 E. Jackson Boulevard, Chicago, Illinois 60604. Telephone (312) 362-8300; e-mail: admitdpu@depaul.edu. The Office of Admission will provide each candidate with the required forms and instructions for filing the application or visit the web site at www.depaul.edu to apply on-line. A non-refundable application fee of $25.00 is required of each applicant. For further information on the regulations and procedures governing admission, consult page 441 of the Bulletin.

ACADEMIC ADVISEMENT
The school believes that academic advisement is necessary for the vitality and success of the student’s undergraduate education. The purposes of liberal education require that the education of the student form a coherent whole. Therefore, the requirements of the Liberal Studies Program and to a degree the major field of study are determined by the individual student’s intellectual interests, needs and abilities.
Students will be assigned a faculty advisor upon admission to the school. Academic approval of a course of study is required of all students in the school. All students are encouraged to meet with their faculty advisor at least once each year to plan their course of study.

PROGRAM AND CURRICULUM INFORMATION
PROFESSIONAL DEVELOPMENT
The School of Computer Science, Telecommunications and Information Systems established the Institute for Professional Development in 1985 to offer certificate programs designed to meet the needs of both individuals and businesses in the Chicagoland area. These non-degree offerings provide intensive training in a wide variety of areas, with each standalone certificate program addressing a different set of theoretical concepts and practical skills. Emphasis is placed on gaining practical experience through a combination of lectures and demonstrations complemented by laboratory exercises and homework assignments. Certificate programs are taught by a team of instructors, that includes full-time faculty with consulting experience and part-time instructors from industry. The programs require a substantial commitment of time, as most meet two nights per week and in the morning on approximately half of the Saturdays during the program.
For application and registration information pertaining to the certificate programs offered by the Institute for Professional Development, please call the Institute office at (312) 362-6282. Current certificate program offerings include:

IPD 370 Advanced SQL Program
A 2-week program covering advanced SQL features

IPD 371 Advanced Oracle PL/SQL Program
A 3-week program covering advanced PL/SQL concepts and programming constructs

IPD 381 Best Practices in Web Design Program
A 7-week comprehensive program covering best practices in web design based on current mark-up, presentation, and accessibility standards

IPD 395 Database Technologies Program
A 12-week comprehensive program covering database applications development and administration using Oracle

IPD 392 IP Telephony Program
A 12-week integrated program focusing on designing and implementing fully converged IP telephony networks.

IPD 380 Information Systems Project Management Program
A 10-week comprehensive program covering current best practices in information systems project management
**IPD 390  Information Systems Security Management Program**
A 10-week comprehensive program covering best practices in designing, implementing and maintaining an organizational information security plan

**IPD 394  J2EE Developer Program**
A 10-week in-depth program covering enterprise-wide applications development using J2EE

**IPD 382  Java Developer Program**
A 10-week comprehensive program covering object-oriented applications development using Java

**IPD 393  Local Area Networks Program**
A 12-week intensive program in the fundamentals of local area networks, wide area networks, and data communications

**IPD 389  .NET Developer Program**
A 10-week comprehensive program covering .NET technologies

**IPD 368/468 .NET Mobile Applications Development Program**
A 10-week focused program covering the basic skills and techniques for successfully building mobile applications using the .NET platform

**IPD 398  .NET Web Services Program**
An 8-week concentrated program covering service-oriented architecture and the development of Web services using the .NET platform

**IPD 396  Network Security Program**
An 11-week intensive program in the fundamentals of network security, hosts security, and Information Assurance

**IPD 376  Oracle Database Availability, Scalability, and Recoverability Program**
A 3-week program covering Oracle database availability, scalability, and recoverability

**IPD 372  Oracle Database Programming Using Open Architecture Program**
A 3-week program covering open architecture database application development

**TRANSFER CREDIT**
Prospective students may transfer credit from an accredited college to DePaul University. All transfer credit will be initially evaluated by an Admission counselor; final course placement will be made by an academic advisor in the School of Computer Science, Telecommunications and Information Systems (CTI). For specific information governing transfer admission and evaluation of credit, please consult page 442 of this Bulletin. Current CTI students may take courses at another accredited college either in the summer or during the regular school year and transfer the credit back to DePaul University only with prior approval from the student's academic advisor.

**GRADES**
Students must earn grades of ‘C’ or above in all courses taken for credit in the major field. Grades of ‘C-’ may be accepted for major field credit provided the overall grade point average within the major is 2.0 or above. All other courses require grades of ‘D’ or better. In addition, all students must fulfill the graduation requirements as noted on page 469 of this Bulletin.

**MODERN LANGUAGE OPTION**
Students in the School of Computer Science, Telecommunications and Information Systems (CTI) may choose to study a modern language and use the credit earned from the language courses to satisfy Liberal Studies domain requirements. Students reduce their Liberal Studies domain requirements by two courses if they complete a three-course language sequence. From the following combinations of learning domains, students can select their two course reduction: Philosophical Inquiry or Religious Dimensions; Understanding the Past or Self, Society and the Modern World; Arts and Literature (at most one course from each combination). The third course in the three-course language sequence may apply as open elective credit only.
BACHELOR OF SCIENCE
LIBERAL STUDIES PROGRAM

The student’s course of study in the Liberal Studies Program is part of the undergraduate program devoted exclusively to liberal education. The program seeks to balance and, when necessary, augment the student’s course in the major field. In addition to the 24 quarter hours required in the liberal studies core, all students in the School are required to complete 52 quarter hours distributed through 6 learning domains as part of one degree program. The number and distribution of courses in each of the areas are as follows:

Liberal Studies Core: 6 courses/24 quarter hours required
First Year Program: (16 quarter hours required) Discover Chicago or Explore Chicago, Focal Point Seminar, and Composition and Rhetoric I and II.
Sophomore Seminar: (4 quarter hours required) Sophomore Seminar on Multiculturalism in the United States
Junior Year Experiential Learning: (4 quarter hours required) If your junior year experiential learning requirement also fulfills a major field requirement, you may substitute a liberal studies domain elective (from outside your major field area) or the third course in the modern language option for this requirement.
Senior capstone: All CTI majors require that students complete the senior capstone in their major field.

Liberal Studies Learning Domains: 13 courses/52 quarter hours required
Arts and Literature: 12 quarter hours required. At most 2 courses from the same department or program. (ART 102 is required for the Bachelor of Science in Computer Graphics and Animation technical designer concentration.)
Philosophical Inquiry: 8 quarter hours required.
Religious Dimensions: 8 quarter hours required; 4 quarter hours in “Patterns and Problems,” and 4 quarter hours in “Traditions in Context.” Note: One course from either Philosophical Inquiry or Religious Dimensions must be a course in ethics. CSC 208 strongly recommended, MGT/PHIL/REL 228 recommended.
Scientific Inquiry: 4 quarter hours required. The course must be designated as a lab course. Courses in mathematics or CTI are not acceptable.
Self, Society and the Modern World: 12 quarter hours required. At most 2 courses from the same department or program. (Psychology 105 is required for the Human-Computer Interaction degree).
Understanding the Past: 8 quarter hours required; 4 quarter hours of history pre-1800 and 4 quarter hours of history 1800-1945. In addition, courses must be from two different categories: 1) Asia, 2) Latin America, 3) Africa, 4) North America or Europe; 5) intercontinental or comparative.

Although study in CTI courses contributes to a student’s liberal education, courses offered through CTI may not be applied towards liberal studies requirements.

ACADEMIC PROGRAMS

BACHELOR OF SCIENCE IN COMPUTER GAMES DEVELOPMENT
The B.S. degree in Computer Games Development reflects the fact that the field of computer games development is tremendously multidimensional and requires expertise from such areas as: game play, game design, art, 3D modeling, animation, procedural art development, physics, programming languages, artificial intelligence to name only a few. The program emphasizes the fact that a game developer needs inspiration from such areas as art, architecture and engineering. Students graduating from this program will be prepared for design, modeling and programming jobs in the gaming industry.

ANI 101 Animation
ANI 200 3D Modeling for Animation and Gaming
ANI 210 3D Animation for Cinema and Gaming
ANI 310 Motion Capture Workshop
CSC 261 Programming Languages I: C/C++
CSC 262 Programming Languages II: C/C++
DC 201 Narrative Techniques in Digital Cinema
GAM 224 Strategies in Game Design
GAM 244 Game Development I
GAM 245 Game Development II
GAM 341 Artifact, Level and Terrain Design
GAM 350 Physics for Game Developers
GAM 374 Action Games Programming
GAM 376 Artificial Intelligence for Computer Games
GAM 378 Strategy Games Programming
GAM 394 Game Development Project I
GAM 395 Game Development Project II
IT 228 Ethics in Computer Games and Cinema
MAT 150 Calculus I
  • Gaming Electives (5)
  • GPH 211 is required as a liberal studies course
  • Open Electives (5)

Gaming Electives
ANI 300 3D Character Animation
Any 200 and 300 level GPH courses
Any 300 level TDC courses
DC 205 Foundations of Digital Cinema
DC 215 Digital Sound Design
DC 220 Non-Linear Editing I
GAM 250 Digital Sound for Computer Games
GAM 380 Console Game Development Environments
GAM 382 Educational and Children’s Games
GAM 385 Introduction to Game Programming in Java
GAM 386 Game Development for Mobile Devices
GAM 390 Multiplayer Game Development
HCI 210 Introduction to Human-Computer Interaction
HCI 360 User-Centered Evaluation
IS 372 Fundamentals of Software Project Management
IS 373 Introduction to Large Systems Implementation
IS 375 Object-Oriented Analysis and Design
IT 130 The Internet and the Web
IT 215 Analysis and Design Techniques
IT 223 Data Analysis
IT 230 Building Internet Applications
IT 236 User Interface Development
IT 240 Introduction to Desktop Databases
MAT 141 Discrete Mathematics II
MAT 151 Calculus II
MAT 220 Linear Algebra with Applications
SE 325 Principles and Practices of Software Engineering
SE 325 Principles and Practices of Software Engineering
SE 330 Object Oriented Modeling
SE 330 Object Oriented Modeling
SE 350 Object-Oriented Software Development

Open Electives
Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.
Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.
BACHELOR OF SCIENCE IN COMPUTER GRAPHICS AND ANIMATION

I. DEVELOPER CONCENTRATION
The developer concentration in the B.S. in Computer Graphics and Animation degree emphasizes software development for such areas as computer animation, video gaming, multimedia, and special effects. It prepares students for such careers as games development, visualization, and modeling.

CMN 220 Public Speaking
CSC 261 Programming Languages I: C/C++
CSC 262 Programming Languages II: C/C++
CSC 321 Design and Analysis of Algorithms
CSC 393 Data Structures in C++
ENG 204 Technical Writing
GPH 211 Perceptual Principles for Digital Environments I
GPH 212 Perceptual Principles for Digital Environments II
GPH 213 Perceptual Principles for Digital Environments III
GPH 325 Survey of Computer Graphics
GPH 329 Computer Graphics Development
GPH 339 Advanced Rendering Techniques
GPH 372 Principles of Computer Animation
GPH 375 Advanced Graphics Development
GPH 395 Computer Graphics Senior Project
HCI 315 Theory and Perception of Color
MAT 140 Discrete Mathematics I
MAT 150 Calculus I
MAT 151 Calculus II
MAT 220 Linear Algebra with Applications
• Graphics Electives (6) (See list below)
• Open Electives (3)

II. TECHNICAL DESIGNER CONCENTRATION
The technical designer concentration in the B.S. in Computer Graphics and Animation degree prepares students to support and engage in the visual aspects of the graphics and entertainment industry, including such careers as technical director for computer animation, games designer, and new media consultant.

ART 106 Beginning Drawing
ART 242 Survey of Asian Art
ART 322 Contemporary Art
CMN 220 Public Speaking
CSC 211 Programming in Java I
CSC 212 Programming in Java II
ENG 204 Technical Writing
GPH 211 Perceptual Principles for Digital Environments I
GPH 212 Perceptual Principles for Digital Environments II
GPH 213 Perceptual Principles for Digital Environments III
GPH 255 Hand Prototyping for Graphic Visualization
GPH 250 Digital Modeling I
GPH 325 Survey of Computer Graphics
GPH 338 Survey of 3-D Animation
GPH 339 Advanced Rendering Techniques
GPH 395 Computer Graphics Senior Project
HCI 210 Introduction to Human-Computer Interaction
HCI 315 Theory and Perception of Color
IT 130 The Internet and the Web
IT 236 User Interface Development
MAT 140 Discrete Mathematics I
• Graphics Elective (4) (See list below)
• Open Electives (4)
• ART 102 Principles of Art History is required as a liberal studies course

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Graphics Electives List
Students may take any of the following courses as long as they were not previously used to satisfy the computer graphics and animation core:
ART 225 Beginning Photography
ART 329 Digital Photography
ART 360 Illustration
ART 373 History of Design
GPH 250 Digital Modeling I
GPH 259 Design Geometry
GPH 329 Computer Graphics Development
GPH 336 Smooth Surface Modeling for Graphics and Animation
GPH 350 Digital Modeling II
GPH 360 Modeling Spaces
GPH 374 Computer Games
GPH 375 Advanced Graphics Development
GPH 376 Artificial Intelligence in Computer Games
GPH 380 Visualization
GPH 389 Real-Time Graphics Techniques
HCI 210 Introduction to Human-Computer Interaction
HCI 270 Formatting Digital Pages I
HCI 271 Formatting Digital Pages II
HCI 322 Multimedia
HCI 341 Usability Issues for Electronic Commerce
IT 223 Data Analysis
IT 236 User Interface Development
MAT 150 Calculus I
MAT 151 Calculus II
MAT 152 Calculus III

Open Electives
Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.
Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

I. COMPUTER SCIENCE CONCENTRATION
CMN 212 Small Group Communication or CMN 220 Public Speaking
CSC 211 Programming in Java I and CSC 212 Programming in Java II
Or CSC 261 Programming Languages I: C/C++ and or CSC 262 Programming Languages II: C/C++
CSC 309 Object-Oriented Programming in C++ or CSC 224 Java for Programmers
CSC 321 Design and Analysis of Algorithms
CSC 373 Computer Systems I
CSC 374 Computer Systems II
CSC 383 Data Structures and Algorithms in Java or CSC 393 Data Structures in C++
CSC 390 Fundamentals of Information Assurance or IT 378 Host and Information Security
CSC 394 Software Projects
ENG 204 Technical Writing or ENG 301 Writing in the Professions
IT 130 The Internet and the Web
IT 223 Data Analysis
IT 240 Introduction to Desktop Databases
IT 263 Applied Networks and Security
MAT 140 Discrete Mathematics I
MAT 141 Discrete Mathematics II
SE 325 Principles and Practices of Software Engineering
SE 350 Object-Oriented Software Development
- 300-level CTI Electives (2) chosen in consultation with student’s advisor.
- Open Electives (6)
- One of the following calculus sequences must be completed (both courses in a sequence must be completed to satisfy this requirement):
  - MAT 147 and MAT 148 Calculus with Integrated Precalculus
  - MAT 160 and 161 Calculus for Mathematics and Science Majors
  - MAT 170 171 – Promath Calculus for Mathematics and Science Majors

**Open Electives**

Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.

Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.

**II. SOFTWARE ENGINEERING HONORS CONCENTRATION**

The Honors Software Engineering (HSE) concentration has been designed for students who are interested in studying advanced software development techniques and technologies. Because of its advanced nature, much of this material is normally accessible only to graduate students. It is therefore only available to students with a strong academic background. Furthermore, students must apply for admission to the program.

Students should apply for the HSE concentration by the end of the winter quarter of their sophomore year, and will be notified of their acceptance (pending completion of requirements) in the spring quarter. Progress will be reviewed at the end of the third year to determine eligibility for continuing to the fourth year. Review is automatic for all students, but students may opt out of review and voluntarily change to another concentration.

**NOTE:** For each graduate course listed below you will participate in a graduate section as an undergraduate. You will receive undergraduate credit and be charged an undergraduate tuition rate. The course number will also be an undergraduate course number to be determined.

- CMN 212 Small Group Communication or CMN 220 Public Speaking
- CNS 390 Fundamentals of Information Assurance
- CSC 211 Programming in Java I and CSC 212 Programming in Java II OR
- CSC 261 Programming Languages I: C/C++ and CSC 262 Programming Languages II: C/C++
- CSC 309 Object-Oriented Programming in C++ or CSC 224 Java for Programmers
- CSC 321 Design and Analysis of Algorithms
- CSC 373 Computer Systems I
- CSC 374 Computer Systems II
- CSC 383 Data Structures and Algorithms in Java or CSC 393 Data Structures in C++
- ENG 204 Technical Writing or ENG 301 Writing in the Professions
- IT 130 The Internet and the Web
- IT 223 Data Analysis
- IT 240 Introduction to Desktop Databases
- IT 263 Applied Networks and Security
- MAT 140 Discrete Mathematics I
- MAT 141 Discrete Mathematics II
- MAT 150 Calculus I
- MAT 151 Calculus II
- SE 325 Principles and Practices of Software Engineering
- SE 352 Object-Oriented Enterprise Application Development
- SE 391 Software Engineering Studio I
- SE 392 Software Engineering Studio II
- XSE 330 Object Oriented Modeling
- XSE 331 Model-Driven Software Development
- XSE 350 Object-Oriented Software Development

Note: XSE courses denotes a undergraduate class cross-listed with a graduate class in which the student will be responsible for graduate level work but will receive undergraduate credit.
- Software Engineering Electives (3 – from a restricted list)
- CTI Electives (1)
- Open Elective (1)

**Software Engineering Electives**

**Open Electives**

Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.

Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.

**BACHELOR OF ARTS AND BACHELOR OF SCIENCE IN DIGITAL CINEMA**

Digitization has caused the convergence of cinema, computer graphics, animation, and gaming. Digital Cinema is an innovative production program dedicated to defining and developing the relationship between changing technologies and creative artistic expression. The convergence of cinema, animation and gaming in the BS and BA in Digital Cinema will train you to redefine cinematic reality.

The B.A. degree, with its greater number of electives, offers the student a chance to create an interdisciplinary program of study.

The B.S. degree, with its increased technical emphasis, provides students with more comprehensive training in the three areas of digital cinema.

**Please note:** Students in the both Digital Cinema programs are required to take 4 quarter hours in Quantitative Reasoning (ISP120) in addition to the nineteen (19) liberal studies courses other CTI majors must take.

**BACHELOR OF ARTS IN DIGITAL CINEMA**

ANI 101 Animation
DC 201 Narrative Techniques in Digital Cinema
DC 205 Foundations of Digital Cinema
DC 210 Digital Cinema Production I
DC 215 Digital Sound Design
DC 220 Non-Linear Editing I
DC 320 Non-Linear Editing II
DC 206 Introduction to Film History
DC 225 Digital Cinema Practicum
DC 273 Film/Video Aesthetics I
DC 275 Cinematography and Lighting
DC 270 Topics in Digital Cinema
DC 310 Digital Cinema Production II
DC 315 Advanced Digital Sound Design
DC 311 Music Video Production
DC 371 Documentary Production
DC 375 High Definition Cinematography
DC 378 Compositing and Special Effects
DC 389 The Big Picture
DC 390 Topics in Directing
DC 395 Topics in Production
DC 398 Digital Cinema Capstone
GAM 224 Strategies in Game Design
- Open Electives (6)
- GPH 211 Perceptual Principles for Digital Environments I is required as one of the A&L Liberal Studies courses.
BACHELOR OF SCIENCE IN DIGITAL CINEMA

ANI 101 Animation
ANI 200 3D Modeling for Animation and Gaming
ANI 210 3D Animation for Cinema and Gaming
ANI 300 3D Character Animation
ANI 310 Motion Capture Workshop
DC 201 Narrative Techniques in Digital Cinema
DC 205 Foundations of Digital Cinema
DC 206 Introduction to Film History
DC 210 Digital Cinema Production I
DC 215 Digital Sound Design
DC 220 Non-Linear Editing I
DC 225 Digital Cinema Practicum
DC 275 Cinematography and Lighting
DC 273 Film/Video Aesthetics I
DC 310 Digital Cinema Production II
DC 315 Advanced Digital Sound Design
DC 320 Non-Linear Editing II
DC 375 High Definition Cinematography
DC 378 Compositing and Special Effects
DC 390 Topics in Directing
DC 395 Topics in Production
DC 398 Digital Cinema Capstone
GAM 224 Strategies in Game Design
GAM 244 Game Development I
GAM 245 Game Development II

- Open Electives (4)
- GPH 211 Perceptual Principles for Digital Environments I is required as one of the A&L Liberal Studies courses.

Open Electives
Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.

Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.

BACHELOR OF SCIENCE IN E-COMMERCE TECHNOLOGY

Students earning the Bachelor of Science program in E-Commerce Technology will acquire computer programming, user-centered design, and E-Commerce system development skills, as well as knowledge of the technology of databases, networking, and middleware.

CMN 212 Small Group Communication or CMN 220 Public Speaking
CSC 211 Programming in Java I
CSC 212 Programming in Java II
ECT 330 Advanced Internet Application Development
ECT 355 E-Commerce Application Models
ECT 359 E-Commerce Technology Senior Project
ECT 360 Introduction to Xml
ECT 365 Web Server Operations
ECT 372 Software Project Development and Management
ENG 204 Technical Writing or ENG 301 Writing in the Professions
HCI 210 Introduction to Human-Computer Interaction
IT 130 The Internet and the Web
IT 201 Introduction to Information Systems
IT 215 Analysis and Design Techniques
IT 223 Data Analysis
IT 230 Building Internet Applications
IT 240 Introduction to Desktop Databases
IT 263 Applied Networks and Security
MAT 140 Discrete Mathematics I or BMS 125 Business Calculus I
SE 330 Object Oriented Modeling
- 300-level CTI elective (2) - chosen in consultation with student’s advisor.
- Open Electives (7)

**Open Electives**
Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.

Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.

**BACHELOR OF SCIENCE IN HUMAN-COMPUTER INTERACTION**

The Bachelor of Science in Human-Computer Interaction is a multidisciplinary degree program designed to study methods that improve the working relationship between humans and computers. HCI practitioners enable individuals and groups to make more effective use of computers by creating better user interfaces and supportive surrounding environments. Drawing on principles from such diverse disciplines as art, psychology, engineering and computer science, HCI involves the analysis, design, development and evaluation of interfaces that are easy to use but powerful enough to accomplish complex tasks.

CMN 212 Small Group Communication or CMN 220 Public Speaking
CSC 211 Programming in Java I
CSC 394 Software Projects
ENG 204 Technical Writing or ENG 301 Writing in the Professions
GPH 211 Perceptual Principles for Digital Environments I
HCI 210 Introduction to Human-Computer Interaction
HCI 270 Formatting Digital Pages I
HCI 360 Evaluating Human-Computer Interaction
IT 130 The Internet and the Web
IT 201 Introduction to Information Systems
IT 215 Analysis and Design Techniques
IT 223 Data Analysis
IT 230 Building Internet Applications
IT 236 User Interface Development
IT 240 Introduction to Desktop Databases
PSY 241 Research Methods I
PSY 242 Research Methods II
- HCI Electives (4)
- Open Electives (8)
- ART 105 is a required Liberal Studies Course

**HCI Elective List**
The degree requires 4 electives chosen from the list of courses below, at least one per group.

**Design:**
ART 261 Art and Design II: Word and Image
ART 264 Typography I
ART 359 Publication Design
GPH 212 Perceptual Principles for Digital Environments II
GPH 250 Digital Modeling I
HCI 271 Formatting Digital Pages II
HCI 315 Theory and Perception of Color
HCI 322 Multimedia
Technology:
CSC 212 Programming in Java II
CSC 351 Database Design
ECT 330 Advanced Internet Application Development
GAM 244 Game Development I
GPH 325 Survey of Computer Graphics
IT 263 Applied Networks and Security

Methods and human factors:
ANT 201 Ethnographic Research Methods
CSC 324 Data Analysis and Statistical Software II
IS 372 Fundamentals of Software Project Management
PSY 360 Theories of Learning and Cognition
PSY 375 Sensation and Perception
PSY 380 Industrial and Organizational Psychology
PSY 383 Psychology of Design

Open Electives
Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.

Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be 'C' or better. Grades of 'C-' may be accepted provided the overall grade point average in the major is 2.0 or better.

Note: Liberal Studies: Required: PSY 105 Introductory Psychology I

BACHELOR OF SCIENCE IN INFORMATION ASSURANCE ENGINEERING

The Bachelor of Science in Information Assurance and Security Engineering prepares students for many possible careers in the rapidly growing Information Assurance and Security industry.
The program of study allow the student to learn the necessary foundations of Information Assurance theory, technology, and technique as well as the knowledge of Security Engineering processes used to implement, support and manage them in real-world systems.
A graduate will be prepared to join an information security team and perform risk assessment, security infrastructure design, network security administration, vulnerability assessment/scanning and incident response as well as any technology position where information security is an important part of the work function.
Graduates’ possible career paths include Information Security Engineer, Technical Security Auditor, Network Security Engineer, Information Assurance Analyst and Forensics Engineer.

ACC 101 Introduction to Accounting I
or FIN 290 Finance for Non-Commerce Majors
CMN 212 Small Group Communication
or CMN 220 Public Speaking
CNS 320 Computer Forensic and Incident Response
CNS 228 Legal, Ethical and Social Issues in Information Security
CNS 340 Fundamentals of Information Assurance
CNS 394 Information Systems Security Engineering I
CNS 395 Information Systems Security Engineering II
CSC 211 Programming in Java I
CSC 212 Programming in Java II
or CSC 261 Programming Languages I: C/C++
CSC 262 Programming Languages II: C/C++
CSC 233 Codes and Ciphers
CSC 373 Computer Systems I
ENG 204 Technical Writing
IT 130 The Internet and the Web
IT 230 Building Internet Applications
IT 240 Introduction to Desktop Databases
IT 263 Applied Networks and Security
IT 378 Host and Information Security
MAT 140 Discrete Mathematics I
TDC 362 Principles of Data Communications
TDC 365 Network Interconnection Technologies
TDC 377 Fundamentals of Network Security
- 300-Level CTI electives (2) - chosen in consultation with your advisor.
- Open Electives (4)

**Open Electives**
Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.

Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.

**BACHELOR OF SCIENCE IN INFORMATION SYSTEMS**

Information Systems is devoted to the application of computers and related technologies to organizational and business problems. IS professionals apply their knowledge of hardware, software, business processes and procedures to help organizations improve performance and meet tactical and strategic goals. IS graduates gain employment in a wide variety of positions, including business application programmers, help desk analysts, end user training and support personnel, database analysts, process consultants, user liaisons, and business system analysts.

CMN 212 Small Group Communication or CMN 220 Public Speaking
CSC 211 Programming in Java I
CSC 212 Programming in Java II
CSC 324 Data Analysis and Statistical Software II
CSC 390 Fundamentals of Information Assurance
ENG 204 Technical Writing or ENG 301 Writing in the Professions
HCI 210 Introduction to Human-Computer Interaction
IS 371 Introduction to I.T. System Management
IS 372 Fundamentals of Software Project Management
IS 373 Introduction to Large Systems Implementation
IS 375 Object-Oriented Analysis and Design
IS 376 Information Systems Project
IT 130 The Internet and the Web
IT 201 Introduction to Information Systems
IT 215 Analysis and Design Techniques
IT 223 Data Analysis
IT 230 Building Internet Applications
IT 236 User Interface Development
IT 240 Introduction to Desktop Databases
IT 263 Applied Networks and Security
- 300-Level CTI electives (2) - chosen in consultation with your advisor.
- Open Electives (7)

**Open Electives**
Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.

Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.
BACHELOR OF ARTS AND BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

BACHELOR OF ARTS
The Bachelors of Arts in Information Technology program will give students a broad education in current areas of information technology, with a focus on producing educated and sophisticated consumers of information technology.

CMN 212 Small Group Communication or CMN 220 Public Speaking
CSC 223 The Impact of Computing Technology On Our Lives
CSC 378 Software Projects for Community Clients
ENG 204 Technical Writing or ENG 301 Writing in the Professions
HCI 210 Introduction to Human-Computer Interaction
ICS 200 Introduction to Business
IT 121 Mathematical and Technological Literacy II
IT 130 The Internet and the Web
IT 201 Introduction to Information Systems
IT 223 Data Analysis or CSC 239 Personal Computing
IT 230 Building Internet Applications
IT 240 Introduction to Desktop Databases
IT 263 Applied Networks and Security or TDC 361 Basic Communication Systems
SOC 394 Sociology and Society (Also counts as a liberal studies course)

- 300-Level CTI electives (8)
- Open Electives (4)
- Technical Grounding Courses (3)

Technical Grounding Courses
CSC 211 Programming in Java I
CSC 212 Programming in Java II
CSC 261 Programming Languages I: C/C++
CSC 262 Programming Languages II: C/C++
ECT 330 Advanced Internet Application Development
GAM 244 Game Development I
GAM 245 Game Development II
GPH 211 Perceptual Principles for Digital Environments I
GPH 212 Perceptual Principles for Digital Environments II
HCI 322 Multimedia
IT 215 Analysis and Design Techniques
IT 230 Building Internet Applications
IT 236 User Interface Development
SE 325 Principles and Practices of Software Engineering
TDC 363 Introduction to Local Area Networks

Open Electives
Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.

Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.
BACHELOR OF SCIENCE
The Bachelor of Science in Information Technology is a technical degree that will instruct students in core competencies in the areas of problem solving and programming, networks and communications systems, databases, Internet and Web technologies, security, and project management, along with a foundation in business concepts and technical communication. The proposed degree is suitable background for employment in the area of software development and testing, application support, network maintenance, database development, IT management, technical sales, technical liaison within a business or operational unit, and IT services.

ACC 101 Introduction to Accounting I or FIN 290 Finance for Non-Commerce Majors
CMN 212 Small Group Communication or CMN 220 Public Speaking
CSC 211 Programming in Java I and CSC 212 Programming in Java II
  or CSC 261 Programming Languages I: C/C++ and CSC 262 Programming Languages II: C/C++
CSC 309 Object-Oriented Programming in C++ (Take this if you took JAVA programming.)
  or CSC 224 Java for Programmers (Take this if you took C++ programming.)
CSC 352 Database Programming
CSC 373 Computer Systems I
CSC 383 Data Structures and Algorithms in Java or CSC 393 Data Structures in C++
ENG 204 Technical Writing or ENG 301 Writing in the Professions
ICS 200 Introduction to Business
IS 372 Fundamentals of Software Project Management
IT 130 The Internet and the Web
IT 215 Analysis and Design Techniques
IT 223 Data Analysis
IT 230 Building Internet Applications
IT 240 Introduction to Desktop Databases
IT 263 Applied Networks and Security
IT 378 Host and Information Security
MAT 140 Discrete Mathematics I
MKT 301 Principles of Marketing
  • Capstone (Any CTI Capstone)
  • Open Electives (5)
  • Expansion Area (4)

EXPANSION AREA
GAM 244 Game Development I
GAM 245 Game Development II
GPH 211 Perceptual Principles for Digital Environments I
GPH 212 Perceptual Principles for Digital Environments II
GPH 213 Perceptual Principles for Digital Environments III
GPH 250 Digital Modeling I
GPH 259 Design Geometry
HCI 210 Introduction to Human-Computer Interaction
HCI 270 Formatting Digital Pages I
HCI 271 Formatting Digital Pages II

Open Electives
Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.

Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.
BACHELOR OF SCIENCE IN MATH/COMPUTER SCIENCE

The Mathematics and Computer Science major is meant for mathematics students with talent and interest in computer science and computer science students with talent and interest in mathematics to develop the necessary background to be able to work in areas which depend on knowledge from both fields. It is designed to prepare the student for graduate study in various areas of computer science such as theoretical computer science, graphics, and computational methods and in areas in applied mathematics such as numerical analysis or discrete mathematics. It is also a good preparation for the more intellectually demanding jobs in computer software development.

CSC 211 Programming in Java I or CSC 261 Programming Languages I: C/C++
CSC 212 Programming in Java II or CSC 262 Programming Languages II: C/C++
CSC 321 Design and Analysis of Algorithms
CSC 373 Computer Systems I
CSC 374 Computer Systems II or CSC 347 Concepts of Programming Languages
CSC 378 Software Projects for Community Clients
or CSC 394 Software Projects
or GPH 395 Computer Graphics Senior Project
or MAT 398 Senior Capstone Seminar
CSC 383 Data Structures and Algorithms in Java or CSC 393 Data Structures in C++
IT 130 The Internet and the Web
MAT 140 Discrete Mathematics I
MAT 141 Discrete Mathematics II
MAT 150 Calculus I
or MAT 160 Calculus for Mathematics and Science Majors I
or MAT 170 Promath Calculus for Mathematics and Science Majors I
or MAT 147 Calculus with Integrated Precalculus I
MAT 151 Calculus II
or MAT 161 Calculus for Mathematics and Science Majors II
or MAT 171 Promath Calculus for Mathematics and Science Majors II
or MAT 148 Calculus with Integrated Precalculus II
MAT 152 Calculus III
or MAT 162 Calculus for Mathematics and Science Majors III
or MAT 172 Promath Calculus for Mathematics and Science Majors III
or MAT 149 Calculus with Integrated Precalculus III
MAT 260 Multivariable Calculus I
MAT 262 Linear Algebra
  ▪ Math Elective (3)
  ▪ Math or CTI Elective (1)
  ▪ CTI Elective (3)

Students choose seven courses from the following area lists. At least three of the courses have to be in computer science (or graphics) and at least three in mathematics. Courses not on this list need to be approved by an advisor. In particular, students are encouraged to take an independent study (MAT 399 or CSC 399).

I. THEORY CONCENTRATION

The theory concentration is aimed at students with an interest in the mathematical and foundations of computer science.
CSC 333 Cryptology
CSC 344 Automata Theory and Formal Grammars
CSC 348 Introduction to Compiler Design
CSC 358 Symbolic Programming
CSC 387 Operations Research I: Linear Programming
  or MAT 387 Operations Research I: Linear Programming
CSC 389 Theory of Computation
MAT 302 Combinatorics
MAT 303 Theory of Numbers
MAT 310 Abstract Algebra I
MAT 311 Abstract Algebra II
MAT 312 Abstract Algebra III  
MAT 351 Probability and Statistics I  
MAT 370 Advanced Linear Algebra  
MAT 372 Logic and Set Theory

II. COMPUTATIONAL METHODS CONCENTRATION
The computational methods concentration is intended for students with an interest in quantitative and computational methods in computer science.
CSC 385 Numerical Analysis or MAT 385 Numerical Analysis I  
CSC 386 Advanced Numerical Analysis or MAT 386 Numerical Analysis II  
MAT 330 Methods of Computation and Theoretical Physics I  
MAT 331 Methods of Computation and Theoretical Physics II

III. GRAPHICS CONCENTRATION
The graphics concentration is intended for students who want to study the technical and mathematical foundations of computer graphics and animation.
GPH 211 Perceptual Principles for Digital Environments I  
GPH 212 Perceptual Principles for Digital Environments II  
GPH 325 Survey of Computer Graphics  
GPH 329 Computer Graphics Development  
GPH 336 Smooth Surface Modeling for Graphics and Animation  
GPH 339 Advanced Rendering Techniques  
GPH 372 Principles of Computer Animation  
MAT 261 Multivariable Calculus II  
MAT 337 Complex Analysis  
MAT 370 Advanced Linear Algebra  
MAT 385 Numerical Analysis I or CSC 385 Numerical Analysis

IV. ARTIFICIAL INTELLIGENCE CONCENTRATION
For students with an interest in the computational relations between syntax and semantics.
CSC 357 Expert Systems  
CSC 358 Symbolic Programming  
CSC 380 Artificial Intelligence

V. DATA ANALYSIS CONCENTRATION
The graphics courses are intended for students who want to study the technical and mathematical foundations of computer graphics and animation.
CSC 328 Data Analysis for Experimenters  
CSC 332 Simulation and Modeling or MAT 359 Simulation Models and the Monte Carlo Method  
CSC 334 Advanced Data Analysis or MAT 354 Multivariate Statistics  
CSC 367 Introduction to Data Mining  
CSC 381 Introduction to Digital Image Processing  
CSC 382 Applied Image Analysis  
CSC 384 Introduction to Computer Vision  
MAT 261 Multivariable Calculus II  
MAT 348 Applied Statistical Methods  
MAT 351 Probability and Statistics I  
MAT 352 Probability and Statistics II  
MAT 353 Probability and Statistics III  
MAT 355 Stochastic Processes  
MAT 356 Applied Regression Analysis  
MAT 357 Nonparametric Statistics  
MAT 370 Advanced Linear Algebra  
MAT 384 Mathematical Modeling
BACHELOR OF SCIENCE IN NETWORK TECHNOLOGIES

I. STANDARD CONCENTRATION
The Bachelor of Science in Network Technologies degree program is designed for students who wish to learn to select, justify, configure, and manage appropriate network technologies for a wide variety of business applications. Course topics include the foundations of networking, local area network design and management, Internet access technologies, routing, and interconnection technologies. There is also a concentration in Network Security.

First Year
CMN 212 Small Group Communication or CMN 220 Public Speaking
CSC 211 Programming in Java I or CSC 261 Programming Languages I: C/C++
CSC 212 Programming in Java II or CSC 262 Programming Languages II: C/C++
ENG 204 Technical Writing or ENG 301 Writing in the Professions
IT 130 The Internet and the Web
IT 201 Introduction to Information Systems
IT 223 Data Analysis
IT 230 Building Internet Applications
IT 240 Introduction to Desktop Databases
IT 263 Applied Networks and Security
MAT 140 Discrete Mathematics I
TDC 311 Computers in Telecommunications Systems
TDC 362 Principles of Data Communications
TDC 363 Introduction to Local Area Networks
TDC 364 Voice Communications Technologies
TDC 365 Network Interconnection Technologies
TDC 376 Network Project
Open Electives (6)
  - 300-level TDC elective chosen in consultation with student’s advisor (3).
  - IT 378 Host and Information Security may be substituted for one of the 300-level TDC electives.

Open Electives
Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.

Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.

II. NETWORK SECURITY
This concentration is designed to provide focused coursework in network security technologies, including detailed instruction in security infrastructure design, deployment, configuration and support.

While this concentration is designed for students that are planning to start their career as network security engineers, security administrators, security auditors and security infrastructure designers, it is also appropriate for any student that wants to integrate security practice within their career.

CMN 212 Small Group Communication or CMN 220 Public Speaking
CSC 261 Programming Languages I: C/C++
CSC 262 Programming Languages II: C/C++
CSC 390 Fundamentals of Information Assurance
ENG 204 Technical Writing or ENG 301 Writing in the Professions
IT 130 The Internet and the Web
IT 201 Introduction to Information Systems
IT 230 Building Internet Applications
IT 240 Introduction to Desktop Databases
IT 263 Applied Networks and Security
IT 378 Host and Information Security
MAT 140 Discrete Mathematics I
TDC 311 Computers in Telecommunications Systems
TDC 362 Principles of Data Communications
TDC 363 Introduction to Local Area Networks
TDC 365 Network Interconnection Technologies
TDC 368 Network Programming
TDC 375 Network Protocols
TDC 376 Network Project
TDC 377 Fundamentals of Network Security
TDC 379 Telecommunication and Network Security Practicum
  • 300-level TDC elective chosen in consultation with student's advisor (2).
  • Open Electives (6)

Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.

Open Electives
Open Electives may be taken from any department or program. These are the only courses that may be taken under the pass/fail option (see the undergraduate Bulletin for details). If you wish to pursue a minor, most minor field courses will be credited as open electives.
Note: Grades for all courses in the students major (i.e. non-Liberal Studies and non-Open Elective) must be ‘C’ or better. Grades of ‘C-’ may be accepted provided the overall grade point average in the major is 2.0 or better.

COMBINED BACHELOR OF SCIENCE AND MASTER OF SCIENCE DEGREES

The Combined Degree Programs at CTI are designed to allow academically gifted students to complete both a bachelor and master’s degree in a shorter amount of time by taking three Master’s level courses in their junior and senior year that count toward both their bachelor and master’s degree requirements at same time. Students in this program will receive both a bachelor degree, after 192 undergraduate credit hours, and a master’s degree after 10 more graduate courses (40 hours), instead of the standard 13 (52 hours).

Admission Criteria
Apply to enter the Combined Degree program any time after having achieved Junior standing (at least 88 credit hours completed) by sending an email to your advisor. Your advisor will then review your record and forward their recommendation along to the admissions office.
GPA of 3.5 or better in courses with a CTI label, eg. CSC, ECT, etc.
Overall GPA is at least 3.2

Maintaining Good Standing
Students who fail to maintain academic standards equivalent to the admission criteria will be dismissed from the Combined Degree and returned to normal undergraduate degree seeking status. Any graduate courses passed before dismissal will not be counted toward graduate credit and may not be retaken. If dismissed students wish to apply to a CTI graduate degree program, they may do so following normal CTI admissions procedures, but will still be required to take 13 graduate courses for a MS degree.

Combined Degree Program Requirements
The tables below list which BS requirement is affected by which BS/MS requirement. The top part of the table deals with the three restricted enrollment graduate courses. The bottom part (light blue) deals with any special requirement due to the prerequisite for the MS (if any).
  Left column lists the undergraduate course students should not take.
  The middle column lists the restricted enrollment courses students should take instead.
  The right column lists the actual graduate course corresponding to the restricted enrollment course.
All other BS requirements remain unchanged. Please refer to the program pages on the CTI web site (http://cs.dePaul.edu/) for the other courses you must take. You need to receive a grade of B- or higher in each course taken to fulfill MS prerequisite requirements. The 10 courses necessary to complete the Master’s Phase of the BS/MS, follow the MS degree program minus the three already taken. For all courses that will be counted toward your MS, you are subject to the same grade requirement as regular MS students. Please work with your advisor to formulate a plan that works best for your circumstances.

### BS Computer Science / MS Computer Science

<table>
<thead>
<tr>
<th>Don’t Take</th>
<th>Take Instead</th>
<th>Corresponding to</th>
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<tbody>
<tr>
<td>SE 350</td>
<td>XSE 350</td>
<td>SE 450</td>
</tr>
<tr>
<td>CSC 321</td>
<td>XCSC 391</td>
<td>CSC 491</td>
</tr>
<tr>
<td>1 CTI 300-level Elective</td>
<td>XCSC 347</td>
<td>CSC 447</td>
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### BS Network Technology - Standard / MS Telecommunications Systems

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<tr>
<th>Don’t Take</th>
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<tbody>
<tr>
<td>TDC 362</td>
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<td>TDC 365</td>
<td>XTDC 363</td>
<td>TDC 463</td>
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</table>

### BS MATH—Computer Science / MS Computer Science

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<th>Don’t Take</th>
<th>Take Instead</th>
<th>Corresponding to</th>
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<tbody>
<tr>
<td>1 CTI 300-level Elective</td>
<td>XSE 350</td>
<td>SE 450</td>
</tr>
<tr>
<td>CSC 321</td>
<td>XCSC 391</td>
<td>SE 491</td>
</tr>
<tr>
<td>CSC 347 or CSC 374</td>
<td>XCSC 347</td>
<td>SE 447</td>
</tr>
<tr>
<td>1 CTI 300-level Elective</td>
<td>CSC 374</td>
<td>Prerequisite phase</td>
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</table>

### BS Computer Science - Standard / MS Software Engineering

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<th>Don’t Take</th>
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<tbody>
<tr>
<td>SE 350</td>
<td>XSE 350</td>
<td>SE 450</td>
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<tr>
<td>1 CTI 300-level Elective</td>
<td>XSE 330</td>
<td>SE 430</td>
</tr>
<tr>
<td>1 CTI 300-level Elective</td>
<td>XSE 377</td>
<td>SE 477</td>
</tr>
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</table>

Students with SE325 and SE477 will be considered to have fulfilled the MS-SE SE425 requirement. Students must meet with their faculty advisor to determine an appropriate SE graduate course to substitute for SE425.

### BS CS – Honors Software Engineering / MS Software Engineering

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<tbody>
<tr>
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<td>XSE 350</td>
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<tr>
<td>SE 430</td>
<td>XSE 331</td>
<td>SE 431</td>
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</table>

Students with SE325 will be considered to have fulfilled the MS-SE SE425 requirement.
### BS Information Systems / MS Computer, Information and Network Security
#### Information Systems Security track

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<th>Take Instead</th>
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<tr>
<td>IS 373</td>
<td>XIS 325</td>
<td>IS 425</td>
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<tr>
<td>1 300-level CTI Elective</td>
<td>XTDC 363</td>
<td>TDC 463</td>
</tr>
<tr>
<td>1 300-level CTI Elective</td>
<td>XIS 372</td>
<td>IS 572</td>
</tr>
<tr>
<td>1 Open Elective</td>
<td>ECT 330 or ECT 353</td>
<td>Prerequisite Phase</td>
</tr>
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</table>

### BS Computer Science / MS Computer, Information and Network Security
#### Computer Security track

<table>
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<th>Take Instead</th>
<th>Corresponding to</th>
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</thead>
<tbody>
<tr>
<td>SE 350</td>
<td>XSE 350</td>
<td>SE 450</td>
</tr>
<tr>
<td>1 300-level CTI Elective</td>
<td>XDS 320</td>
<td>DS 420</td>
</tr>
<tr>
<td>1 300-level CTI Elective</td>
<td>XTDC 372</td>
<td>TDC 572</td>
</tr>
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</table>

### BS Math--Computer Science / MS Computer, Information and Network Security
#### Computer Security track

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<th>Corresponding to</th>
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<tbody>
<tr>
<td>1 300-level CTI Elective</td>
<td>XSE 350</td>
<td>SE 450</td>
</tr>
<tr>
<td>1 300-level CTI Elective</td>
<td>XDS 320</td>
<td>DS 420</td>
</tr>
<tr>
<td>1 300-level CTI Elective</td>
<td>XTDC 372</td>
<td>TDC 572</td>
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<tr>
<td>CSC 347 or CSC 374</td>
<td>CSC 374</td>
<td>Prerequisite Phase</td>
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### BS Network Technology / MS Computer, Information and Network Security
#### Network Security track

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<td>TDC 362</td>
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<td>TDC 460</td>
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<td>TDC 365</td>
<td>XTDC 363</td>
<td>TDC 463</td>
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<tr>
<td>1 300-level TDC Elective</td>
<td>CNS 340</td>
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### BS Computer Science / MS in Distributed Systems

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<td>XSE 350</td>
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<tr>
<td>CSC 321</td>
<td>XCSC 391</td>
<td>CSC 491</td>
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<td>XDS 320</td>
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### BS in Math--Computer Science / MS in Distributed Systems

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<tr>
<td>CSC 321</td>
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<td>1 CTI 300-level Elective</td>
<td>CSC 374</td>
<td>Prerequisite phase</td>
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</table>
BACHELOR OF ARTS IN COMPUTING

The Bachelor of Arts in Computing is offered jointly by the School of Computer Science, Telecommunications and Information Systems and the School for New Learning. This degree is designed for working adults at least 24 years of age, who wish to obtain credit for their careers as technology professionals, and gain new skills in problem-solving, design, testing and communicating. The BA in Computing differs from the BS in Computer Science in that the BS places heavier emphasis on traditional programming and formal algorithmic analysis. The BA in computing program focuses on relating program design and computing to organizational dynamics and human relations. It helps to prepare students to analyze and negotiate the social, ethical, and technological systems of a business and to act as a liaison between the technical and non-technical sides of a company.

The computer competences in the BA in Computing program cover a variety of topics directly related to current industry practice. These competences include skills and knowledge in information systems, data communications, databases, software engineering, and the design and evaluation of user interfaces. In the general studies area of the program, competences are tied to the humanities, the natural sciences and the social sciences. Students may select competences in the arts, design, ecology, human biology, multicultural relations, and politics and so on that are tailored to their individual goals and interests. The BA in Computing is completed by satisfying a total of fifty (50) competences; this amounts to the equivalent of 140 quarter hours. Typically these competences are satisfied through course work or equivalent work experience.

For a copy of the Program Guide for the Bachelor of Arts in Computing or to make reservations for a BA in Computing Information Session, please call either the School of Computer Science, Telecommunications and Information Systems at (312)362-8381 or the School for New Learning at (312)362-8001.

SPECIAL PROGRAMS

TEACHER OF COMPUTER SCIENCE: SECONDARY LEVEL

In cooperation with the School of Education, the School of Computer Science, Telecommunications and Information Systems (CTI) offers a concentration of study which combines the requirements for a major in Computer Science with certification for teaching computer science at the junior high, middle, and senior high school levels. A student electing such a program should consult the School of Education counselor as soon as possible after entering DePaul.

MINORS

A minor is a combination of courses that provides a cohesive introduction to an area of study. Typically, courses taken to satisfy minor field requirements are credited as open electives; however, there are some instances where minor field courses may be used for credit in other areas of the student's curriculum. Grades for all courses, taken to fulfill a minor field requirement must be 'C' or above. Grades of 'C-' may be accepted for credit in the minor provided the minor GPA is 2.0 or above. A minimum of one-half of the courses required for a minor must be completed at DePaul University.

MINORS IN THE COLLEGE OF COMMERCE

Students enrolled in the School of Computer Science, Telecommunications and Information Systems (CTI) may obtain a minor in Accounting, Business Administration, E-Business, Economics, Management, MIS, Marketing, and Pre-MBA. Please see the College of Commerce Section for Minor Requirements.

MINORS IN THE COLLEGE OF LIBERAL ARTS AND SCIENCES

Students enrolled in the School of Computer Science, Telecommunications and Information Systems (CTI) may obtain a minor through the College of Liberal Arts and Sciences. Most Liberal Arts and Science departments offer minor concentrations of study. In general, a minor in a Liberal Arts and Sciences discipline consists of a set of introductory courses plus another set of more specialized courses. Most minors require six courses, some of which may also be used for credit in the Liberal Studies Program. For a complete list of minors offered through the College of Liberal Arts and Sciences, please consult that section of this online Bulletin.
MINORS IN THE COLLEGE OF COMPUTER SCIENCE, TELECOMMUNICATIONS AND INFORMATION SYSTEMS

Minors Within CTI for CTI Students
To obtain a minor in CTI when the major is also in CTI:
1. Satisfy all requirements for the major
2. Satisfy all requirements for the minor
3. Students must take at least 6 courses in the minor area that do not count towards their CTI major

Note: If you have already taken some of the courses listed under your minor on this page, work with your advisor to choose other courses within the same program area, i.e. NT minor would look under NT major courses and Computer Graphics Software Development would look under Computer Graphics Courses, in order to have 6 distinct courses.

CTI MINOR REQUIREMENTS FOR NON-CTI MAJORS

Computer Games Development Minor
DC 201 Narrative Techniques in Digital Cinema
GPH 211 Perceptual Principles for Digital Environments I
GPH 212 Perceptual Principles for Digital Environments II
GPH 213 Perceptual Principles for Digital Environments III
GAM 224 Strategies in Game Design
GAM 244 Game Development I
GAM 245 Game Development II

Computer Graphics Software Development Minor
CSC 261 Programming Languages I: C/C++
CSC 262 Programming Languages II: C/C++
GPH 211 Perceptual Principles for Digital Environments I
GPH 212 Perceptual Principles for Digital Environments II
GPH 329 Computer Graphics Development
GPH 339 Advanced Rendering Techniques

Computer Science Minor
CSC 211 Programming in Java I or CSC 261 Programming Languages I: C/C++
CSC 212 Programming in Java II or CSC 262 Programming Languages II: C/C++
CSC 309 Object-Oriented Programming in C++ or CSC 224 Java for Programmers
CSC 393 Data Structures in C++ or CSC 383 Data Structures and Algorithms in Java
IT 130 The Internet and the Web
IT 240 Introduction to Desktop Databases
MAT 140 Discrete Mathematics I
• 1 300-level CTI elective

Data Analysis Minor
CSC 211 Programming in Java I
CSC 212 Programming in Java II
CSC 324 Data Analysis and Statistical Software II
IT 130 The Internet and the Web
IT 223 Data Analysis
IT 240 Introduction to Desktop Databases

One course from the following list:
• CSC 328 Data Analysis for Experimenters
• CSC 334 Advanced Data Analysis

Digital Modeling Minor
GPH 211 Perceptual Principles of Digital Environments I
GPH 212 Perceptual Principles of Digital Environments II
GPH 259 Design Geometry
GPH 250 Digital Modeling I
GPH 350 Digital Modeling II
GPH 360 Modeling Spaces
• Special Topics/Independent Project

Digital Cinema Minor
DC 205 Foundations of Digital Cinema
DC 225 Digital Cinema Practicum
DC 201 Narrative Techniques in Digital Cinema
DC 220 Non-Linear Editing I

Three courses from the following list:
ANI 101 Animation
DC 210 Digital Cinema Production I
DC 215 Digital Sound Design
DC 275 Cinematography and Lighting
DC 310 Digital Cinema Production II
DC 320 Non-Linear Editing II
DC 389 The Big Picture: the Entertainment Industry
GAM 224 Strategies in Game Design
GPH 211 Perceptual Principles for Digital Environments I
TDC 350 Modes of Digital Distribution

E-Commerce Technology Minor
CSC 211 Programming in Java I
CSC 212 Programming in Java II
ECT 330 Advanced Internet Application Development
HCI 210 Introduction to Human-Computer Interaction
IT 130 The Internet and the Web
IT 230 Building Internet Applications

One course from the following list:
• ECT 355 E-Commerce Application Models
• ECT 360 Introduction to Xml
• ECT 365 Web Server Operations

Human-Computer Interaction Minor
IT 130 The Internet and the Web
or HCI 201 Multimedia and the World Wide Web
HCI 210 Introduction to Human Computer Interaction
PSY 105 Introduction to Psychology I
GPH 211 Perceptual Principles for Digital Environments I
or ART 105 Two-Dimensional Foundations
HCI 270 Formatting Digital Pages I
or ART 227 Computer Applications for Design I: Illustrator and Photoshop
HCI 360 User-Centered Evaluation

One course from the following list:
• HCI 271 Formatting Digital Pages II
• HCI 322 Multimedia
• IT 215 Analysis and Design Techniques
• IT 230 Building Internet Applications
• IT 240 Introduction to Desktop Databases
• CSC 211 Programming in Java I
• IT 223 Data Analysis
• PSY 240 Statistics I
• PSY 241 Research Methods I

Information Systems Minor
CSC 211 Programming In Java I
HCI 210 Introduction To Human-Computer Interaction
IT 130 The Internet And The Web
IT 201 Introduction To Information Systems
IT 215 Analysis And Design Techniques
IT 230 Building Internet Applications
IT 240 Introduction To Desktop Databases

One course from the following list:
- IS 371 Introduction To I.T. System Management
- IS 372 Fundamentals Of Software Project Management
- IS 373 Introduction To Large Systems Implementation
- IS 374 Management Support Systems

**Information Technology Minor**
IT 130 The internet and the Web
IT 230 Building Internet applications
IT 240 Introduction to desktop databases
TDC 361 Basic Communication Systems
or IT 263 Applied Networks and Security
IT 215 Analysis and Design Techniques

One additional CTI course.

**Network Technology Minor**
CSC 211 Programming in Java I
or CSC 261 Programming Languages I: C/C++
CSC 212 Programming in Java II
or CSC 262 Programming Languages II: C/C++
IT 130 The Internet and the Web
IT 201 Introduction to Information Systems
IT 263 Applied Networks and Security
TDC 362 Principles of Data Communications
TDC 363 Introduction to Local Area Networks

**Security Minor**
IT 130 The Internet and the Web
AND CSC 211 Programming in Java I
AND CSC 212 Programming in Java II
OR
CSC 261 Programming Languages I: C/C++
AND CSC 262 Programming Languages II: C/C++
CSC 233 Codes and Ciphers
or CSC 333 Cryptology
IT 378 Host and Information Security
CNS 320 Computer Forensic and Incident Response
CNS 228 Legal, ethical, and social issues in information security
CNS 340 Fundamentals of Information Assurance

**COURSES**
Please visit Campus Connection at [https://campusconnect.depaul.edu](https://campusconnect.depaul.edu) for current course information. If you do not have a password for Campus Connection you may log on as a guest. Once you are on Campus Connection please select Course Catalog followed by the department.