

## COMPUTER INFORMATION TECHNOLOGY BS, CERTIFICATES AND MINORS

### Computer Information Technology

College of Science, Engineering & Technology  
Department of Computer Information Science  
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Website: [cset.mnsu.edu/cis](http://cset.mnsu.edu/cis)

Chair: Mahbubur Syed

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Computer Information Technology (CIT) in its broadest sense encompasses all aspects of computing technology. CIT, as an academic discipline, focuses on meeting the needs of users within an organizational and societal context through the selection, creation, application, integration and administration of computing technologies. The aim is to provide CIT major graduates with the skills and knowledge to take on appropriate professional positions upon graduation and to grow into leadership positions or pursue research or graduate studies in the field. The CIT program also has six minors.

The program's mission is to ensure that each graduate is exceptionally well qualified to undertake a successful information career in industry, business, education, or government. In support of this mission, the program is designed so that each student will:

- Gain a sound foundation in computing basics, analysis and design, programming, testing, software development, security, database, software QA and testing and web application design and development.
- Learn the theory and practice of information technology and develop skills to apply this knowledge to analyze and solve problems.
- Develop analytical, critical thinking, and interpersonal skills applicable to real-world problem solving.
- Develop effective oral and written communication skills.
- Appreciate the social and ethical issues in information technology.

#### Academic Map/Degree Plan at [www.mnsu.edu/programs/#All](http://www.mnsu.edu/programs/#All)

#### POLICIES/INFORMATION

**Admission to Major** is granted by the department. Admission to the Major is required before the student is permitted to take 300- and 400-level courses. Requirements are:

- A minimum of 32 earned semester credits
- Completion of MATH 121 with a grade of "C" or better
- Completion of ENG 101 with a grade of "C" or better
- Completion of IT 210 with a grade of 3.0 or better and IT 214 with a grade of 2.0 or better (or in their equivalents).

**GPA Policy.** The completion of any major or minor in the Department of Computer Information Science requires **both**:

- a GPA of 2.5 or higher for all **departmental** courses (IT), or their substitutions, used to complete the major or minor, and
- a GPA of 2.5 or higher for **all** courses, or their substitutions, used to complete the major or minor. This includes all departmental courses, supporting courses, and General Education courses **required** for the major or minor.

It is recommended that students who cannot maintain a GPA of 3.0 in required 100 and 200 level courses see their advisor for a program review.

**Grade Policy.** All coursework used to complete a departmental major or minor, including required courses, required supporting courses, and required General Education courses, must be taken for a letter grade except for courses offered only as P/N.

No course completed with a grade of "D" can be used to complete a departmental major or minor program, or to meet a departmental prerequisite.

**Registration Hold Policy.** The department will place a registration hold on any student who earns a "D" or "F" in any of its courses. The department will also place such a hold on any student who drops any of its courses after the first two weeks of the semester. A student with a registration hold cannot register for courses until the hold is released, which requires filling out an appeal form and taking it to the student's advisor for discussion. Appeal forms are available from the departmental office. This hold policy does NOT apply to students who are taking 100-level IT courses.

**Dual Major Policy.** Students can earn at most one undergraduate major from this department.

**Incomplete Policy.** The department gives incomplete grades for only two conditions. The first condition is illness, which requires a doctor's written recommendation. The second condition arises when a death in the student's family has caused the student to be away from the campus for an extended period. The student must have a satisfactory grade ("C" or better) in the course at the time of the onset of the condition.

**Internship Policy.** The Department of Computer Information Science continuously strives for improvements in the academic program. Coursework, coupled with extensive laboratory experience, play an important part in the student's educational program. However, application of the concepts discussed in class to on-the-job situations is equally important. As a result, the department requires an internship or a capstone experience for all IT majors.

**Excluded Courses Policy.** IT 201, IT 296 do not count toward a major or minor in the department.

**Residency Policy.** Students must earn at least 50 percent of the credits required for a departmental major or minor at Minnesota State Mankato.

#### COMPUTER INFORMATION TECHNOLOGY BS

Degree completion = 120 credits

#### Required General Education

ENG	101	Composition (4)
IT	202W	Computers in Society (4)
STAT	154	Elementary Statistics (4)
MATH	121	Calculus I (4)
(choose one of the following CMST Courses) (3 credits)		
CMST	100	Fundamentals of Communication (3)
CMST	102	Public Speaking (3)
CMST	312	Professional Communication & Interviewing (4)

#### Major Common Core

Three credits of IT 497 are required for the major. Additional credits may only be used to satisfy degree requirements.

ENG	271	Technical Communication (4)
IT	210	Fundamentals of Programming (4)
IT	214	Fundamentals of Software Development (4)
IT	310	Data Structures & Algorithms (4)
IT	320	Machine Structures and Operating Systems (4)
IT	340	Introduction to Database Systems (4)
IT	350	Information Security (4)
IT	360	Introduction to Data Communication and Networking (4)
IT	380	Systems Analysis & Design (4)
IT	440	Database Management Systems (4)
IT	497	Internship (1-12)

#### Major Restricted Electives

Choose 12 credits from any courses listed in the bulletin with denomination IT 4xx and have not been used to fulfill any other requirements.

#### Required Minor: Yes, Any (Computer Science excluded)

#### COMPUTER INFORMATION SCIENCE MINOR

#### Required for Minor

IT	210	Fundamentals of Programming (4)
IT	214	Fundamentals of Software Development (4)
(choose three of the following courses)		
IT	483	Web Applications and User Interface Design (4)
IT	320	Machine Structures and Operating Systems (4)

## COMPUTER INFORMATION TECHNOLOGY CONTINUED

- IT 340 Introduction to Database Systems (4)
- IT 360 Introduction to Networking (4)
- IT 380 Introduction to Software Engineering (4)

### COMPUTER TECHNOLOGY MINOR

#### Required for Minor

- IT 100 Introduction to Computing and Applications (4)
- IT 202W Computers in Society (4)
- IT 210 Fundamentals of Programming (4)
- (choose 8 credits) (choose two of the following)
- IT 214 Fundamentals of Software Development (4)
- IT 340 Introduction to Database Systems (4)
- IT 350 Information Security (4)
- IT 360 Introduction to Networking (4)
- IT 380 Systems Analysis and Design (4)

### DATABASE TECHNOLOGIES MINOR

#### Required for Minor

- IT 210 Fundamentals of Programming (4)
- IT 214 Fundamentals of Software Development (4)
- IT 340 Introduction to Database Systems (4)
- (choose two of the following courses)
- IT 440 Database Management Systems (4)
- IT 442 Database Security, Auditing, and Disaster Recovery (4)
- IT 444 Data Analytics (4)

### INTERNATIONAL TECHNOLOGY MINOR

This minor is designed to allow the student to gain technology project experience in a cross-cultural and cross-disciplinary environment. The student will participate in the process of conceiving, designing and implementing technological solutions/products in this environment.

#### Minor Core

Study abroad to earn at least 12 credits. For international students, this must be in a country whose culture differs significantly from the student's home country. The international program of study must be approved by both the student's advisor and by the chair of the Computer Information Science Department. The 12 credits can be taken as IT 390 or as other courses as determined and approved by the student, advisor, and CIS chair.

#### Elective

For Majors in CIS Department (choose 8 credits)

When this minor accompanies a major from the Computer Information Science Department, choose 8 credits of 300- and 400-level IT courses. These courses must not be included among those used to complete the requirements for the major.

IT 300 - IT 499

For Majors from another department (choose 8 credits)

When this minor accompanies a major from another department, choose 8 credits of IT courses numbered 200 and above.

IT 200 - IT 499

### NETWORKING AND INFORMATION SECURITY MINOR

#### Required for Minor

- IT 210 Fundamentals of Programming (4)
- IT 214 Fundamentals of Software Development (4)
- IT 350 Information Security (4)
- IT 360 Introduction to Networking (4)
- (choose one of the following courses)
- IT 450 Information Warfare (4)
- IT 460 Network and Security Protocols (4)
- IT 462 Network Administration and Programming (4)

### SOFTWARE DEVELOPMENT MINOR

#### Required for Minor

- IT 210 Fundamentals of Programming (4)
- IT 214 Fundamentals of Software Development (4)
- IT 310 Data Structures and Algorithms (4)
- IT 380 Systems Analysis and Design (4)

(choose one for the following courses)

- IT 414 Advanced Object-Oriented Programming w/Design Patterns (4)
- IT 480 Software Quality Assurance and Testing (4)
- IT 484 Software Engineering (4)

### CERTIFICATE PROGRAMS

Requirements for Certificate Programs in Computer Information Technology.

#### Admission Requirements

Knowledge of programming (equivalent of IT 210 and IT 214) or equivalent programming experience.

#### Prerequisites Requirements

For the Undergraduate Certificate Programs in IT, all of the Certificates' prerequisite requirements can be met through Minnesota State Mankato coursework, transfers, substitutions and/or waivers, as may be appropriate.

#### Completion Requirements

Without exception, the twelve credits of coursework required for each Certificate must all be completed in the Department of Computer Information Science at Minnesota State University, Mankato.

### DATABASE TECHNOLOGIES CERTIFICATE

The Database Technologies undergraduate certificate provides students with the necessary knowledge to apply information technology principles and theory so they are able to address real world business and organizational challenges and opportunities. This certificate focuses on planning, designing, programming and developing secure databases, and the challenges and specific issues in maintaining, managing and securing databases. Students are introduced to the security challenges and threats in database systems and are provided an understanding of the state-of-the art security technologies, and data recovery strategies.

**Prerequisites.** Students must have fundamental knowledge or experience of database (equivalent of IT 340). Students planning to take IT 442 must also have knowledge or experience of information security (equivalent of IT 350). Students planning to take IT 483 must have basic knowledge or experience of database (equivalent of IT 340). (choose three of the following courses) (12 credits)

- IT 440 Database Management Systems (4)
- IT 442 Database Security, Auditing, and Disaster Recovery (4)
- IT 444 Data Analytics (4)
- IT 483 Web Application and User Interface Design (4)

### INFORMATION SECURITY CERTIFICATE

The Information Security certificate provides students with the necessary knowledge in information security principles and practices and an understanding of how information security functions in an organization from both business and technology aspects. The program will engage students with a thorough review of viruses, worms, backdoors, Trojan horses, Rootkits, and other threats. Students will analyze malware in order to understand the infection, propagation, and deception mechanisms of these attack vectors. It will also focus on risk assessment to identify reasonably foreseeable internal and external risks to the security, confidentiality and integrity of user information and assess the sufficiency of any safeguards in place to control these risks.

**Prerequisites.** Students planning to take IT 460 must have basic knowledge of or experience in data communications and networking (equivalent of IT 360). Students planning to take IT 442 must have basic knowledge of or experience in databases (equivalent of IT 340).

(choose three of the following courses) (12 credits)

- IT 350 Information Security (4)
- IT 442 Database Security, Auditing, and Disaster Recovery (4)
- IT 450 Information Warfare (4)
- IT 460 Network and Security Protocols (4)

### NETWORKING TECHNOLOGIES CERTIFICATE

The Networking Technologies certificate provides students with the necessary knowledge in networking principles, administration, programming, security issues and practices so that they are able to apply them in real world organizational challenges and opportunities. The students completing this certificate program will understand and evaluate current and emerging networking and security technologies and assess their applicability to address the needs of individuals and organizations.

**Prerequisites.** Students planning to take IT 462 must have basic knowledge of or experience in information security (equivalent of IT 350). Students planning to take IT 483 must have basic knowledge of or experience in databases (equivalent of IT 340). (choose three of the following courses) (12 credits)

- IT 360 Introduction to Networking (4)
- IT 460 Network and Security Protocols (4)

- IT 462 Network Administration and Programming (4)
- IT 483 Web Application and User Interface Design (4)

## SOFTWARE DEVELOPMENT CERTIFICATE

The software development certificate provides the students with an understanding of the successful delivery of software projects that support organizational goals. Students gain knowledge in the use of tools necessary to organize project objectives, create realistic plans, and build and manage an accomplished team through every phase of the software development project. Students gain practical skills needed to meet today's demands for faster and more efficient development.

**Prerequisites:** Students must have fundamental knowledge of or experience in systems analysis and design (equivalent of IT 380). Students planning to take IT 414 must also have basic knowledge of or experience in data structures and databases (equivalent of IT 310 and IT 340). Students planning to take IT 483 must have basic knowledge of or experience in databases (equivalent of IT 340). (choose three of the following courses) (12 credits)

- IT 414 Advanced Object-Oriented Programming w/Design Patterns (4)
- IT 480 Software Quality Assurance and Testing (4)
- IT 482 Human Computer Interaction (4)
- IT 483 Web Applications and User Interface Design (4)
- IT 484 Software Engineering (4)

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## COURSE DESCRIPTIONS

### IT 100 (4) Introduction to Computing and Applications

Basic foundations in computer concepts. Topics include: hardware, software, uses of technology in industry, and ethical, and social issues. Lab work covers various systems and applications software including word processing, email, the Internet, spreadsheets, databases, and presentation software.

Fall, Spring  
GE-9, GE-13

### IT 101 (3) Introduction to Information Systems

Introduction to personal computers as productivity tools for business majors. Using Microsoft Office suite, students learn to be productive with document processing, spreadsheets, electronic presentations, and databases. Cannot be used toward any major or minor in Information Systems & Information Technology.

Fall, Spring

### IT 113 (4) Synergy between Health Humanities, Healthcare Informatics and Outcome Measures

This course uses health humanities storytelling to prepare students with a sincere concern for human values within the capture, management, and evaluation of health information. Students will explore the synergy between health related data, healthcare informatics, and outcome measures. Students will gain fundamental information technology skills to understand and critique data, identify relationships between visual arts and written works regarding health, and explore cultural aspects of healthcare experiences and risk adjustment of quality outcome measures.

All Year: Fall; On Demand: Spring, Summer

GE-6, GE-7

Diverse Cultures - Purple

### IT 201 (2) Introduction to Assistive Technology

This course introduces students to assistive technology and its applicability to people with various disabilities. Hardware and software demonstrations with an emphasis placed on inexpensive and readily available solutions. Extensive use of the Internet will be employed to keep current with latest technology and to facilitate a continuing dialogue with instructor.

Variable

### IT 202W (4) Computers in Society

Students prepare written summaries and oral presentations related to the complex social and ethical issues associated with computers. Through thoughtful questions, informative readings, and the analysis of opposing viewpoints, participants gain insight into the complexity of technology-related issues in a world without clearly defined borders.

Fall, Spring

WI, GE-9, GE-13,

### IT 210 (4) Fundamentals of Programming

This is the first course for students planning to major or minor in Information Systems or Information Technology. Programming in a high-level language, abstraction and problem-solving skills are emphasized.

Prerequisite: MATH 112 or MATH 113 or MATH 115 or MATH 121 or MATH 180  
Fall, Spring

### IT 214 (4) Fundamentals of Software Development

A continuation of IT 210, IT 214 introduces object-oriented concepts, programming techniques, lists, stacks, queues, and trees. Students are expected to produce larger applications, utilizing multiple compilation units.

Prerequisite: (EE 107 or IT 210) and (MATH 113 or MATH 115 or MATH 121 or MATH 180)

Fall, Spring

### IT 213 (4) Applied Programming for Healthcare Professionals

This course reviews basic programming concepts such as data types and variables, loops, functions, input/output and visualization. Students become prepared to produce larger, more complex applications. A strong emphasis on problem-solving as students explore how programming concepts are applied to scenarios drawn from healthcare and other domains. Students develop programming skills necessary to implement data structures, exception handling, and object-oriented concepts. Students are also introduced to incremental program development, testing, and debugging.

Prerequisite: MATH 115, IT 210

Fall, Spring, Summer

### IT 296 (1-2) Introduction to Selected Topics

Special topics not covered in other 100- and 200-level courses. May be repeated for each new topic.

### IT 310 (4) Data Structures & Algorithms

Study of trees, hashing, and graph algorithms. Analysis of algorithms, memory management, and proof techniques.

Prerequisite: IT 214

Variable

### IT 311 (4) Business Application Programming

Business application development using a non-object oriented programming language. Emphasis on principles of application programming such as control breaks, read a record/write a line, driver, shared sub-routines, pass by reference, and sub-programming. File concepts emphasized include index-sequential file handling, CRUD, heap files, sorting, transaction, and master files. Programming concepts include input-processing-output definitions, understanding requirements, structure charts, program documentation, and programming standards. Large group project is completed during semester.

Prerequisite: IT 214

Spring

### IT 320 (4) Machine Structures and Operating Systems

Introduction to computer hardware, Boolean logic, digital circuits, data representations, digital arithmetic, digital storage, performance metrics, pipelining, memory hierarchy, and I/O; Operating System concepts, interface, multi-tasking, threads, memory and file management, tools.

Prerequisite: IT 214

Fall, Spring

### IT 340 (4) Introduction to Database Systems

Introduction to database systems, entity relationship models, relational algebra, database design, data modeling, normalization, and conversion of business rules into relational model. Introduction to basic SQL including subqueries, joins, functions, sequences, triggers, views, and stored procedures.

Prerequisite: IT 210, a 3.0 or higher grade in IT 210 or in an approved substitute is required.

Fall, Spring

### IT 350 (4) Information Security

Security concepts and mechanisms; security technologies; authentication mechanisms; mandatory and discretionary controls; cryptography and applications; threats; intrusion detection and prevention; regulations; vulnerability assessment; information assurance; forensics; anonymity and privacy issues; disaster recovery planning, legal issues and ethics.

Prerequisite: a 3.0 or higher grade in IT 210 or in an approved substitute is required.

Fall, Spring

**IT 360 (4) Introduction to Networking**

This course covers basic concepts related to computer networking. Topics addressed will include the OSI model, the Internet model, network management, network protocols and data security.

Prerequisite: a 3.0 or higher grade in IT 210 or in an approved substitute is required.  
Fall, Spring

**IT 380 (4) Systems Analysis and Design**

This course explores both structured as well as object oriented systems analysis and design. Use of upper and lower CASE tools are employed in the analysis, design and implementation of a team oriented term project.

Prerequisite: IT 214, IT 340  
Fall, Spring

**IT 390 (12) International Technology Experience**

Study abroad for one semester to participate in a project-based technology/media-oriented program of study. The program of study must be one approved by the student's advisor and the chair of this department.

Prerequisite: Permission  
Fall, Spring

**IT 398 (0) CPT: Co-Operative Experience**

Curricular Practical Training: Co-Operative Experience is a zero-credit full-time practical training experience for one summer and on adjacent fall or spring term. Special rules apply to preserve full-time student status. Please contact an advisor in your program for complete information.

Prerequisite: IT 380. At least 60 credits earned; in good standing; instructor permission; co-op contract; other prerequisites may also apply.  
Fall, Spring, Summer

**IT 414 (4) Advanced Object-Oriented Programming with Design Patterns**

This course provides student with a solid understanding of the principles, techniques and design patterns involved in advanced object-oriented programming. Successful students should have a distinct advantage in the marketplace.

Prerequisite: IT 310, IT 380  
Variable

**IT 418 (4) Foundations of Data Science**

This course provides an introduction to data science, discusses opportunities and challenges associated with data science projects, and develops competencies related to data collection, data cleaning, data analysis, and model evaluation. The course focuses on hands-on exercises using data analytics tools.

Prerequisite: IT 310, IT 340  
Fall Odd Years

**IT 440 (4) Database Management Systems**

Extensive coverage of SQL, database programming, large scale data modeling, and database enhancement through reverse engineering. This course also covers theoretical concepts of query processing, and optimization, basic understanding of concurrency control and recovery, and database security and integrity in centralized/distributed environments. Team-oriented projects in a heterogeneous client server environment.

Prerequisite: IT 380  
Fall, Spring

**IT 442 (4) Database Security, Auditing, and Disaster Recovery**

Covers science and study of methods of protecting data, and designing disaster recovery strategy. Secure database design, data integrity, secure architectures, secure transaction processing, information flow controls, inference controls, and auditing. Security models for relational and object-oriented databases.

Prerequisite: IT 350, IT 440  
Variable

**IT 443 (4) Health Information Technology in Clinical Practice**

This course introduces students to a variety of existing and emerging technologies used within healthcare environments. Emphasis will be on software used to capture clinical data and generate reports. Students will complete a team oriented project incorporating business requirements, project management, and design elements for a system implementation, system change, or reporting request.

Prerequisite: IT 113, IT 340  
Fall, Spring, Summer

**IT 444 (4) Data Analytics**

The course explores big data in structured and unstructured data sources. Emphasis is placed on big data strategies, techniques and evaluation methods. Various data analytics are covered. Students experiment with big data through big data analytics, data mining, and data warehousing tools.

Prerequisite: IT 310, IT 440

**IT 450 (4) Information Warfare**

Covers information warfare principles and technologies. Information warfare concepts; Protocols, Authentication, and Encryption; Network attack techniques, methodologies, and tools; Network defense; Malware: trojans, worms, viruses, and malicious code; Electronic crimes and digital evidence.

Prerequisite: IT 350  
Fall

**IT 460 (4) Network and Security Protocols**

Advanced coverage of data communication, networking and security protocols. Topics: transmission methods, error detection and recovery, flow control, routing, security issues and performance analysis of existing and emerging protocols for secure communication.

Prerequisite: IT 360  
Variable

**IT 462 (4) Network Security, Administration and Programming**

Network and server systems administration. Domain administration; file system management; networked printers; user management; workstation configuration. Network programming assignments/projects in Layered Software Systems, HTTP Server, UDP (TFTP or DNS), CGI program, IPV6, RPC/SCTP.

Prerequisite: IT 360  
Variable

**IT 464 (4) Applications of Wireless and Mobile Networks**

Existing and emerging mobile and wireless data networks with emphasis on digital data communications. Gain an understanding of the unique considerations that must be given to network protocols for wireless and mobile communication and their applications.

Prerequisite: IT 360  
Variable

**IT 465 (4) Mobile Device Application Programming**

This course is designed to give students the skills required to write applications for mobile devices (smartphones and tablets). Topics to be covered include interacting with the UI, using an emulator/simulator, application lifecycle, moving from one screen to another, services, alarms, broadcast receivers, maps API, location based programs, gps, persistence, hardware sensors, and web applications.

Prerequisite: IT 310, IT 380  
Variable

**IT 480 (4) Software Quality Assurance and Testing**

Topics include software quality assurance, software quality metrics, software configuration management, software verification and validation, reviews, inspections, and software process improvement models, functional and structural testing models.

Prerequisite: IT 310, IT 380  
Fall, Spring

**IT 482 (4) Human Computer Interaction**

This course discusses concepts and techniques for design, development and evaluation of user interfaces. Students will learn the principles of interaction design, interaction styles, user-centered design, usability evaluation, input/output devices, design and analysis of controlled experiments and principles of perception and cognition used in building efficient and effective interfaces. Group project work.

Prerequisite: IT 380 or CS 230; STAT 154 or PSYC 201 and MATH 121  
Fall

**IT 483 (4) Web Applications and User Interface Design**

HTTP Protocol; Web-markup languages; Client-side, Server-side programming; Web services; Web servers; Emerging technologies; Security; Standards & Bodies; Web interface design techniques; User-centered design; Visual development environments and development tools; Interface design effectiveness.

Prerequisite: IT 380  
Fall, Spring

**IT 484 (4) Software Engineering**

An introduction to all important aspects of software engineering. The emphasis is on principles of software engineering including project planning, requirements gathering, size and cost estimation, analysis, design, coding, testing, implementation, and maintenance. Group project work.

Prerequisite: IT 310, IT 380  
Fall, Spring

### **IT 485 (4) Game Design and Development**

This course is designed to give students the skills required to design and develop video games. The primary focus of the course is on mobile game development, game design principles and user-centered design methodologies. A play-centric approach to game design and development will be studied, discussed and applied in the production of a game demo.

Prerequisite: IT 310, IT 380

Spring: On Demand: Fall, Summer

### **IT 495 (1) Seminar in Information Technology**

Provides Information Technology majors an opportunity, in a small group setting, to explore a topic not normally covered in the curriculum.

Prerequisite: Consent

Variable

### **IT 496 (1-4) Selected Topics in Information Technology**

Special topics not covered in other courses. May be repeated for credit on each new topic.

Prerequisite: Consent

Variable

### **IT 497 (1-12) Internship**

Provides students with opportunity to utilize their training in a real-world business environment working under the guidance and direction of a faculty. (At most 4 hours toward a major in this department.)

Prerequisite: Permanent admission to IT and consent

Fall, Spring, Summer

### **IT 498 (4) Information Technology Capstone**

Develop high quality software application researching and applying fundamental software engineering techniques, several advanced development and test tools, human factors of interface design and a team approach, each student controlling only a part of the system.

Prerequisite: Senior Standing and consent

Fall, Spring

### **IT 499 (1-4) Individual Study**

Problems on an individual basis.

Prerequisite: Consent

Fall, Spring