INFORMATION SCIENCE AND TECHNOLOGY

Information science and technology offers a bachelor's degree focused on today’s cutting-edge information technology. Students in information science and technology study the latest technology in areas including business analytics & data science, networking, database management systems, telecommunications, enterprise resource planning, human-computer interaction, e-commerce, and integrated business systems. Professionals in this field administer, maintain, and support computer systems and networks.

Today's business environments have a critical need for professionals who have an understanding of information technologies based on a broad knowledge of management practices, economics, psychology, and the humanities. These individuals are needed to implement technology to support business processes, managerial decision-making, and organizational communication.

As an information science and technology major, you will take courses that are rigorous and oriented toward building the foundation necessary for lifetime learning. Studying at Missouri S&T, you will benefit from the world-class computer environment and your association with excellent students from around the country and the world. Students in the program are strongly encouraged to do summer internships or co-ops with companies before they graduate. There are many rich opportunities and students benefit greatly in terms of their education and the edge they have seeking full-time employment once they graduate.

Bachelor of Science
Information Science and Technology

In Information Science and Technology, the Bachelor of Science degree consists of 120 credit hours. All undergraduate students in Business and Management Systems are required to complete a General Education Requirements Core, including courses in Humanities, Social Sciences, Mathematics, Science, and Communication Skills.

A common departmental core of courses in Management and Information Technology helps provide students with skills to succeed in a fast-changing and globalized environment. Information Science and Technology (IST) Core courses and IST Electives provide students with comprehensive knowledge of information technology utilization in businesses. These courses include business analytics & data science, database management, systems analysis, introduction to data science and management, computer internals, networks and communications, and electronic and mobile commerce. The electives for this degree consist of advanced coursework in the areas introduced by the required courses.

A minimum grade of "C" is required in the IST Core, IST Electives, Management, and Information Technology courses. Students have 9 credit hours for free electives.

### Freshman Year

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<th></th>
<th>First Semester</th>
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<th>Credits</th>
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<tr>
<td>BUS 1810¹</td>
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<td>PSYCH 1101</td>
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<td>ENGLISH 1120</td>
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<td>MATH 1212</td>
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<td>MATH 1140²</td>
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<td>BUS 1110</td>
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<tr>
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<td>Total Credits: 120</td>
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¹ Writing intensive course
² Any course in the following areas: biology, chemistry, geology, geological engineering, physics.
³ Any course in the following areas not used for other degree requirements: art, economics, English, foreign language, history, literature, music, philosophy, political science, psychology, sociology, theater.
⁴ A grade of “C” or better is required in IS&T electives and emphasis area courses for graduation. Students choosing the human-computer interaction emphasis area must take IS&T 5885, IS&T 5886, and IS&T 5887. Students choosing the enterprise resource planning emphasis area must take 9 hours of ERP-designated courses at the 4000-level or above. Students who choose no emphasis area must take three courses from: IS&T 4000-level or above, ERP 4000-level or above, COMP SCI 4700, COMP SCI 5601.
⁵ MATH 1120 may be substituted for MATH 1140.

### Sophomore Year

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<th>Credits</th>
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###Junior Year

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<td>FINANCE 2150</td>
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### Senior Year

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<th>Credits</th>
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<td>Fine Art, Social Science, or Humanities Elective³</td>
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<td>POL SCI 1200</td>
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<td>IS&amp;T Elective or Emphasis Area⁴</td>
<td>3</td>
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<tr>
<td>History Elective</td>
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<td>Free Electives</td>
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<td>15</td>
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Total Credits: 120
Emphasis Areas

Two emphasis areas may be taken to specialize if the student wishes to do so. The first, human-computer interaction, consists of three courses:

- IS&T 5885 Human-Computer Interaction 3
- IS&T 5886 Prototyping Human-Computer Interactions 3
- IS&T 5887 Human-Computer Interaction Evaluation 3

The second emphasis area, enterprise resource planning, consists of any 9 hours of ERP-designated courses at the 4000-level or above.

Minors

You must see the department advisor and complete a minor application before beginning your minor. Requirements change over time. You will be held to the requirements in force at the time you apply for the minor. Postponing your application for the minor may result in you having to take additional courses to complete the minor. At least six (6) hours of the minor course work must be taken in residence at Missouri S&T.

Minor in Business

The minor in business and management systems requires the following 15 hours of coursework:

- FINANCE 2150 Corporate Finance I 3
- ECON 1100 Principles Of Microeconomics 3
  or ECON 1200 Principles Of Macroeconomics 3
- BUS 1110 Introduction to Management and Entrepreneurship 3
- BUS 1210 Financial Accounting 3
- MKT 3110 Marketing 3

Minor in Business Analytics and Data Science

The minor in business analytics and data science requires the following 15 hours of coursework:

- IS&T 1750 Introduction to Management Information Systems 3
- IS&T 3423 Database Management 3
- IS&T 3420 Introduction to Data Science and Management 3

And two of the following:

- IS&T 4450 Introduction to Information Visualization 3
- IS&T 5420 Business Analytics and Data Science 3
- IS&T 5001 Data Methodologies in Python 3

Minor in Cybersecurity Management and Information Assurance

This minor requires the following 15 hours of coursework:

The following three courses are required:

- BUS 5910 Privacy and Information Security Law 3
- IS&T 4780 Human and Organizational Factors in Cybersecurity 3
- IS&T 3333 Data Networks and Information Security 3

Two of the following three courses must also be taken:

- ERP 5240 Enterprise Application Development and Software Security 3
- IS&T 4335 Fundamentals of Mobile Technology for Business 3
- IS&T 4641 Digital Commerce and the Internet of Things 3

Minor in Digital Supply Chain Management

The minor in digital supply chain management requires the following 15 hours of coursework:

- BUS 5360 Business Operations 3
  or MECH ENG 3653 Manufacturing 3
- ERP 5310 Supply Chain Management Systems in an ERP Environment 3
- ERP 4610 Customer Relationship Management in ERP Environment 3
  or MECH ENG 5760/ Probabilistic Engineering Design 3
- AERO ENG 5760 2

Two courses from the following list:* 6

- ERP 5410 Use of Business Intelligence 3
- ERP 5110 Enterprise Resource Planning Systems Design and Implementation 3
- MECH ENG 5708 Rapid Product Design And Optimization 3
- MECH ENG 5656 Design For Manufacture 3
- MECH ENG 5757/ ENG MGT 5515 Integrated Product And Process Design 3
- MECH ENG 5763 Principles And Practice Of Computer Aided Design 3

* Non business and information technology students must select ERP 5110 as one of the two electives.

Minor in Electronic and Social Commerce

The minor in electronic and social commerce requires the following 15 hours of coursework:

- IS&T 4641 Digital Commerce and the Internet of Things 3

Four courses from the following list: 12

- IS&T 4335 Fundamentals of Mobile Technology for Business 3
- IS&T 5251 Technological Innovation Management and Leadership 3
- IS&T 5652 Advanced Web Development 3
- IS&T 5168 Law and Ethics in E-Commerce 3
- IS&T 5885 Human-Computer Interaction 3
- IS&T 5886 Prototyping Human-Computer Interactions 3
- MKT 5310 Digital Marketing and Promotions 3
- MKT 4880 Marketing Strategy 3

Minor in Enterprise Resource Planning (ERP)

The minor in ERP requires the following 15 hours of coursework:

- BUS 1210 Financial Accounting 3
- ERP 2110 Introduction to Enterprise Resource Planning 3
- ERP 5110 Enterprise Resource Planning Systems Design and Implementation 3

Six credit hours of electives from any other ERP-designated courses at the 4000-level or above 6

Total Credits 15

Minor in Entrepreneurship

The minor in entrepreneurship requires the following 15 hours of coursework:

- BUS 1110 Introduction to Management and Entrepreneurship 3
- BUS 5980 Business Models for Entrepreneurship and Innovation 3
- MKT 5310 Digital Marketing and Promotions 3

Two courses from the following list: 6

- BUS 4150 Customer Focus and Satisfaction 3
- BUS 5580 Strategic Management 3
- IS&T 4641 Digital Commerce and the Internet of Things 3
- IS&T 4664 Web and Digital Media Development 3
- IS&T 4335 Fundamentals of Mobile Technology for Business 3
- IS&T 5251 Technological Innovation Management and Leadership 3
Minor in Finance
The minor in finance requires the following 15 hours of coursework:

- ECON 1100 Principles Of Microeconomics 3
- or ECON 1200 Principles Of Macroeconomics
- FINANCE 2150 Corporate Finance I 3
- Three additional FINANCE electives at the 3000 level or above (Undergraduate Research is acceptable) 9

Total Credits 15

Minor in Human-Computer Interaction and User Experience
The minor in human-computer interaction and user experience requires the following 15 hours of coursework:

- IS&T 4654 Web and Digital Media Development 3
- IS&T 4680 Introduction to Web and New Media Studies 3
- IS&T 5885 Human-Computer Interaction 3
- IS&T 5886 Prototyping Human-Computer Interactions 3
- IS&T 5887 Human-Computer Interaction Evaluation 3

Minor in Information Science and Technology
The minor in information science and technology requires the following 15 hours of coursework:

- IS&T 1750 Introduction to Management Information Systems 3
- IS&T 1551 Implementing Information Systems: User Perspective 3
- IS&T 1552 Implementing Information Systems: Data Perspective 3
- ERP 2110 Introduction to Enterprise Resource Planning 3
- One other IS&T or ERP course at the 2000-level or above. 3

Total Credits 15

Minor in Management
The minor in management requires the following 15 hours of coursework:

- BUS 1110 Introduction to Management and Entrepreneurship 3
- Four courses from the following list: 12
  - BUS 2910 Business Law
  - BUS 3115 Introduction to Teambuilding and Leadership
  - BUS 4111 Business Negotiations
  - BUS 4150 Customer Focus and Satisfaction
  - BUS 5360 Business Operations
  - BUS 5470 Human Resource Management
  - BUS 5580 Strategic Management
  - IS&T 4261 Information Systems Project Management
  - ENG MGT 3320 Introduction to Project Management

Minor in Marketing
The minor in marketing requires the following 15 hours of coursework:

- ECON 1100 Principles Of Microeconomics 3
- or ECON 1200 Principles Of Macroeconomics
- MKT 3110 Marketing 3
- Three courses from the following list: 9
  - MKT 3210 Consumer Behavior
  - MKT 5310 Digital Marketing and Promotions
  - MKT 4150 Customer Focus and Satisfaction
  - MKT 4580 Marketing Strategy
  - ERP 4610 Customer Relationship Management in ERP Environment
  - Other marketing electives approved by the department (MKT 3000 and above)

Minor in Mobile Business and Technology
The minor in mobile business and technology requires the following 15 hours of coursework:

- IS&T 4641 Digital Commerce and the Internet of Things 3
- IS&T 4335 Fundamentals of Mobile Technology for Business 3
- ERP 5240 Enterprise Application Development and Software Security 3
- Two courses from the following list: 6
  - IS&T 3333 Data Networks and Information Security
  - IS&T 5652 Advanced Web Development
  - IS&T 5886 Prototyping Human-Computer Interactions
  - ERP 4610 Customer Relationship Management in ERP Environment
  - ERP 5310 Supply Chain Management Systems in an ERP Environment
  - ERP 5210 Performance Dashboard, Scorecard and Data Visualization

Carla Pauline Bates, Assistant Teaching Professor
MASTER Missouri S&T

Darryl Lee Brinkmann, Adjunct Instructor
MASTER Sangamon State University

Randy Lawrence Canis, Adjunct Professor
JD University of Missouri-Columbia

Langtao Chen, Assistant Professor
PHD Georgia State University

Yu Hsien Chiu, Associate Teaching Professor
MASTER University of Wisconsin-Milwaukee

Craig C Claybaugh, Associate Professor
PHD University of Wisconsin-Milwaukee

Arlan Dekock, Professor Emeritus
PHD University of South Dakota

Cassandra Carlene Elrod, Associate Professor
PHD University of Missouri-Rolla

Li-Li Eng, Associate Professor
PHD University of Michigan Ann Arbor

Hanqing Fang, Assistant Professor
PHD Mississippi State University

Nobuyuki Fukawa, Associate Professor
PHD Louisiana State University

Richard H Hall, Professor
PHD Texas Christian University

Michael Gene Hilgers, Professor
PHD Brown University

Bih-Ru Lea, Associate Professor
PHD Clemson University

Chris J Merz, Adjunct Instructor
PHD University of California-Irvine
Fiona Fui-Hoon Nah, Professor
PHD University of British Columbia

Nicholas Oswald, Adjunct Instructor
MASTER Missouri University of Science & Technology

Keng Leng Siau, Professor
PHD University of British Columbia

James K Tharp, Adjunct Instructor
MBA Webster University

Nathan W Twyman, Assistant Professor
PHD University of Arizona

Wen-Bin Yu, Associate Professor
PHD University of Louisville

Hongxian Zhang, Assistant Professor
PHD University of Texas at San Antonio

IS&T 1001 Special Topics (IND 0.0-6.0)
This is designed to give the department an opportunity to test a new course. Variable title.

IS&T 1551 Implementing Information Systems: User Perspective (LEC 3.0)
Introduction to object-oriented programming in the context of developing and implementing the various components of an information system with particular attention given to system interface such as window and web forms. Class will include numerous projects covering foundational programming.

IS&T 1552 Implementing Information Systems: Data Perspective (LEC 3.0)
Continuation of object-oriented programming in the context of developing and implementing the various components of an information system with particular attention given to database incorporation. Class will include numerous projects covering intermediate topics. Prerequisite: IS&T 1551.

IS&T 1750 Introduction to Management Information Systems (LEC 2.0 and LAB 1.0)
This course familiarizes the students with the fundamental concepts and principles of management information systems. Topics covered include the strategic role of IT, decision support systems, database and data warehouse, enterprise applications, mobile applications, and social and ethical issues related to information systems.

IS&T 2000 Special Problems (IND 0.0-6.0)
Problems or readings on specific subjects or projects in the department. Consent of instructor required.

IS&T 2001 Special Topics (IND 0.0-6.0)
This is designed to give the department an opportunity to test a new course. Variable title.

IS&T 2002 Cooperative Training in Information Science & Technology (IND 0.0-6.0)
On-the-job experience gained through cooperative education with industry with credit arranged through departmental co-op advisor. Grade received depends on quality of reports submitted and work supervisor’s evaluation. Prerequisite: Completed 30 hours toward degree.

IS&T 3000 Special Problems (IND 0.0-6.0)
Problems or readings on specific subjects or projects in the department. Consent of instructor required.

IS&T 3001 Special Topics (LEC 0.0-6.0)
This course is designed to give the department an opportunity to test a new course. Variable title.

IS&T 3131 Computing Internals And Operating Systems (LEC 3.0)
Design-oriented introduction to computer components and operation. Standard codes; number systems; base conversions; computer arithmetic; boolean algebra; operating system components including memory management, device management, and I/O management; and related issues are covered. Prerequisite: IS&T 1552 or Comp Sci 1510.

IS&T 3321 Network Performance Design And Management (LEC 3.0)
This course provides analytical capabilities needed to effectively design, deploy, and manage computer networks and protocols. Prerequisites: IS&T 3333.

IS&T 3333 Data Networks and Information Security (LEC 3.0)
The course provides an overview of current and evolving networking and information security principles. Concepts include network standards and protocols; operation and management; switching and routing; area networks; wireless network infrastructure; security frameworks, policies, and management. Prerequisites: IS&T 1750; IS&T 1552 or Comp Sci 1510.

IS&T 3343 Systems Analysis (LEC 3.0)
Introduction to the processes by which business information systems are analyzed, designed, and introduced into the business environment. Topics include investigation of existing systems, requirements analysis, logical and physical design, database design, forms design, and report analysis. Prerequisite: IS&T 3423.

IS&T 3420 Introduction to Data Science and Management (LEC 3.0)
Introduces students to increasing business success through analysis of large-scale data collections. Topics include: import/export of data, summary statistics, cross-tabulation, data transformations (sub setting, merging, sorting and aggregation), modeling methods, and visualization. Significant programming in R is expected. Prerequisites: IS&T 1552 or Comp Sci 1510.

IS&T 3423 Database Management (LEC 3.0)
The course introduces the concepts of database management systems. Issues in database architecture, design, administration, and implementation are covered. Prerequisites: IS&T 1750; IS&T 1552 or Comp Sci 1510.

IS&T 3443 Database Applications in Business (LEC 3.0)
Design, development and implementation of application software typical to the modern business environment utilizing popular commercial database management systems such as Oracle and Access. Focus given to business case modeling, requirement analysis, database design, and implementation challenges. Project oriented. Prerequisite: IS&T 3343.

IS&T 3553 Modular Software Systems in Java (LEC 3.0)
Introduction to Software Life Cycle and characteristics of large modular software systems. Exploration of software support for such systems, using Java, including use of GUI interfaces, advanced I/O and String handling, Interfaces, Threads, and other modularity features. Program project included. Prerequisites: IS&T 1552 and IS&T 3131.

IS&T 4001 Special Topics (LEC 0.0-6.0)
This is designed to give the department an opportunity to test a new course. Variable title.

IS&T 4099 Undergraduate Research (IND 0.0-6.0)
Designed for the undergraduate student who wishes to engage in research. Not for graduate credit. Not more than six credit hours allowed for graduation credit. Subject and credit to be arranged with the instructor.
IS&T 4257 Network Economy (LEC 3.0)
Emerging Network/internet economy, using traditional economic tools. Topics: production and reproduction cost of information, information as an "experience good," versions of products, switching cost, lock-in effects, market adoption dynamics, first-mover advantage, intellectual property rights. Prerequisite: Econ 1100 or Econ 1200. (Co-listed with Econ 4130).

IS&T 4261 Information Systems Project Management (LEC 3.0)
The course overviews general project management principles and then focuses on information system application development. Topics include requirements analysis, project scheduling, risk management, quality assurance, testing, and team coordination. Prerequisites: IST 1552 or Comp Sci 1510; Senior Standing.

IS&T 4335 Fundamentals of Mobile Technology for Business (LEC 3.0)
A broad overview of mobile technology use in business environments. Topics include the mobile industry; mobile network and wireless standards; mobile devices; mobile web design and app development; social and user experience issues; mobile marketing and commerce. Prerequisites: IS&T 3333.

IS&T 4450 Introduction to Information Visualization (LEC 3.0)
Topics include: the visualization development framework, traditional presentations of data, human perception and aesthetics, colorspace theory, visualization algorithms and software, modern visualizations of large data sets. Application of R packages will be emphasized throughout. Prerequisites: Statistics, Calculus, and Programming Knowledge.

IS&T 4641 Electronic and Mobile Commerce (LEC 3.0)
Introduction to fundamental concepts of management and application to IT and support of commerce. Examines the use of IT in business processes and the management issues of integrating IT into organization processes to gain a competitive advantage. Prerequisites: IS&T 1750 and at least Sophomore standing.

IS&T 4642 E-Commerce Architecture (LEC 3.0)
Course will cover the issues associated with computer architecture, as it relates specifically to e-commerce applications. Topics will include e-commerce systems and processes, specialized software, and databases. Prerequisite: IS&T 3333.

IS&T 4654 Web and Digital Media Development (LEC 3.0)
This course covers techniques and tools for design and development of web-based media, including text, graphics, animation, audio, and video.

IS&T 4680 Introduction to Web and New Media Studies (LEC 3.0)
The course covers web culture, including topics such as social media, citizen journalism, crowd intelligence, privacy, and copyright. Prerequisite: Junior or Senior standing.

IS&T 4780 Human and Organizational Factors in Cybersecurity (LEC 3.0)
In-depth examination of human and organizational factors in cybersecurity and information assurance. Study of how to protect information integrity, availability, and confidentiality, as well as tools, methods, principles, and analytics for fraud prevention, insider threat detection, and forensic investigations. Assumes prior exposure to cybersecurity or IA.

IS&T 5000 Special Problems (IND 0.0-6.0)
Problems or readings on specific subjects or projects in the department. Consent of instructor required.

IS&T 5001 Special Topics (LEC 0.0-6.0)
This is designed to give the department an opportunity to test a new course. Variable title.

IS&T 5040 Oral Examination (IND 0.0)
After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D. students may be processed during intersession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

IS&T 5099 Research (IND 0.0-15)
Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required.

IS&T 5131 Foundations of Computer Architecture (LEC 3.0)
Design-oriented foundations of computer components and operation. Standard codes; number systems; base conversions; computer arithmetic; boolean algebra; operating system components including memory management, device management; plus related computer architecture topics. Research paper required. Prerequisites: IS&T 1552 and graduate standing.

IS&T 5168 Law and Ethics in E-Commerce (LEC 3.0)
Provides the ethical framework to analyze the ethical, legal, and social issues that arise for citizens and computer professionals regarding the computerization of society. Topics include: free speech, privacy, intellectual property, product liability, and professional responsibility. (Co-listed with Philos 4368).

IS&T 5251 Technological Innovation Management and Leadership (LEC 3.0)
The course focuses on the knowledge and skills necessary for the development and implementation of effective strategies for the management of technology-based organizations. This involves: developing a general management perspective on technology and innovation, examining the problems of new product development, identifying distinctive technological competencies, licensing and marketing technologies, assessing the organizational and industrial context of technology. Prerequisite: Senior or Graduate Standing.

IS&T 5420 Business Analytics and Data Science (LEC 3.0)
Analysis of large business data sets via statistical summaries, cross-tabulation, correlation, and variance matrices. Techniques in model selection, prediction, and validation utilizing general linear and logistic regression, Bayesian methods, clustering, and visualization. Extensive programming in R is expected. Prerequisites: Calculus, Statistics, and Programming knowledge.

IS&T 5423 Foundations of Data Management (LEC 3.0)
Foundational concepts of database management systems. Issues in database architecture, design, administration, and implementation. Extensive use of SQL with Oracle to create and manage databases. Significant project dealing with triggers or stored procedures. Prerequisites: IS&T 1750, IS&T 1552, and graduate standing.

IS&T 5520 Data Methodologies in Python (LEC 3.0)
Python methodologies for manipulating, processing, cleaning, grouping, slicing, reshaping and summarizing information in data-intensive applications; managing files, scraping web pages, mining social media; describing, modeling, analyzing, and visualizing data. Tools include pandas, NumPy, SciPy, and Matplotlib libraries. Prerequisites: One of Stat 3111, Stat 3113, Stat 3115, Stat 3117 and either IS&T 1552 or Comp Sci 1510; for Graduate Students: Graduate Standing and Knowledge of Calculus, Statistics, and Programming.
**IS&T 5652 Advanced Web Development** (LEC 3.0)
Advanced Web development techniques to provide dynamic interaction; methods for extracting and delivering dynamic information to/from Web servers - a hands-on approach. Emphasis on interaction with servers; mobile software development; processing of graphics and web video. Project work is required. Prerequisites: IS&T 1551 and IS&T 4654.

**IS&T 5885 Human-Computer Interaction** (LEC 3.0)
Introduction to the field of Human-Computer Interaction (HCI). Students examine issues and challenges related to the interaction between people and technology. The class explores the social and cognitive characteristics of people who use information systems. Students learn techniques for understanding user needs, interface prototyping & interface evaluation.

**IS&T 5886 Prototyping Human-Computer Interactions** (LEC 3.0)
This course explores novel HCI and UX technologies as well as methods and tools for creating system prototypes, including best practices and guidelines for optimal user experiences. Example concepts include mobile applications, behavioral monitoring, gamification, natural user interfaces, haptics, and computers as social actors. Prerequisite: Preceded or accompanied by IS&T 5885.

**IS&T 5887 Human-Computer Interaction Evaluation** (LEC 1.5 and LAB 1.5)
This course covers research and analysis methods and tools for evaluation of the impact of information technology systems on humans and organizations. The focus will be on practical evaluation with the goal of providing recommendations for improving system functionality and usability. Prerequisite: Preceded or accompanied by IS&T 5885.