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 lifelong 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 (IS&T) Core courses and IS&T 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, computing 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 IS&T Core, IS&T Electives, Management, and Information Technology courses. Students have 9 credit hours for free electives.

Freshman Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
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</tr>
</thead>
<tbody>
<tr>
<td>BUS 1810(^1)</td>
<td>3</td>
<td>PSYCH 1101</td>
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</tr>
<tr>
<td>ENGLISH 1120</td>
<td>3</td>
<td>MATH 1212</td>
<td>4</td>
</tr>
<tr>
<td>IS&amp;T 1750</td>
<td>3</td>
<td>IS&amp;T 1561</td>
<td>3</td>
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<tr>
<td>7 credit hours of Mathematical Science or Science(^5)</td>
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<td><strong>Total Credits:</strong></td>
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Sophomore Year

<table>
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<td>SP&amp;M S 1185</td>
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<td>IS&amp;T Elective (^4)</td>
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<td>STAT 3111</td>
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<td>ERP 2110</td>
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Junior Year

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<td>FINANCE 2150</td>
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<td>MKT 3110</td>
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<td>IS&amp;T 3423</td>
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<td>IS&amp;T 3333</td>
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<td>IS&amp;T 4641</td>
<td>3</td>
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<tr>
<td>IS&amp;T Elective (^4)</td>
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<td>ENGLISH 2560 or TCH COM 2560</td>
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<tr>
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Senior Year

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<th>Second Semester</th>
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<tr>
<td>Free Elective</td>
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<td>BUS 5980</td>
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<tr>
<td>Fine Art, Social Science, or Humanities Elective(^3)</td>
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<td>POL SCI 1200</td>
<td>3</td>
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<tr>
<td>IS&amp;T Electives (^4)</td>
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<td>IS&amp;T Elective(^4)</td>
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<tr>
<td>History Elective</td>
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<td>Free Electives</td>
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<tr>
<td><strong>Total Credits:</strong></td>
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Total Credits: 120

A grade of “C” or better is required in the following courses for graduation:

- BUS 1110, BUS 1210, BUS 1810, BUS 5980, ECON 1100, ECON 1200, ERP 2110, FINANCE 2150, MKT 3110, IS&T 1561, IS&T 1562, IS&T 1750, IS&T 3131, IS&T 3333, IS&T 3343, IS&T 3420, IS&T 3423, IS&T 4641, IS&T 4654, and all IS&T Electives.

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 elective courses for graduation. Electives may be:
   - any IS&T or ERP designated course at the 3000-level or above
   - BUS 5730,
   - BUS 5910,
   - COMP SCI 4700
   - or COMP SCI 5601.
5. Mathematical Science is defined as any MATH, STAT, COMP SCI or IS&T course not otherwise covered in the degree program. For definition of Science, refer to footnote 2.
6. ENGLISH 1160 may be substituted for ENGLISH 1600.

\(^1\) A grade of “C” or better is required in the following courses for graduation:

- BUS 1110, BUS 1210, BUS 1810, BUS 5980, ECON 1100, ECON 1200, ERP 2110, FINANCE 2150, MKT 3110, IS&T 1561, IS&T 1562, IS&T 1750, IS&T 3131, IS&T 3333, IS&T 3343, IS&T 3420, IS&T 3423, IS&T 4641, IS&T 4654, and all IS&T Electives.

- A grade of “C” or better is required in IS&T elective courses for graduation. Electives may be:
   - any IS&T or ERP designated course at the 3000-level or above
   - BUS 5730,
   - BUS 5910,
   - COMP SCI 4700
   - or COMP SCI 5601.

- Mathematical Science is defined as any MATH, STAT, COMP SCI or IS&T course not otherwise covered in the degree program. For definition of Science, refer to footnote 2.

- ENGLISH 1160 may be substituted for ENGLISH 1600.
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 Artificial Intelligence and Machine Learning in Business

The Minor requires 15 credit hours, as follows:

- BUS 5730 Machine Learning and Artificial Intelligence for Business 3
- IS&T 5535 Machine Learning Algorithms and Applications 3
- IS&T 3420 Introduction to Data Science and Management 3

And two courses from the following list: 6

- STAT 3111 Statistical Tools For Decision Making
- IS&T 3333 Data Networks and Information Security
- IS&T 3343 Systems Analysis
- IS&T 5420 Business Analytics and Data Science
- IS&T 5450 Introduction to Information Visualization
- IS&T 5520 Data Science and Machine Learning with Python
- ERP 5410 Use of Business Intelligence

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
- or BUS 1414 The Inclusive Workplace 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 courses from the following list: 6

- IS&T 4641 Digital Commerce and IoT Analytics
- IS&T 5420 Business Analytics and Data Science
- IS&T 5450 Introduction to Information Visualization
- IS&T 5520 Data Science and Machine Learning with Python
- BUS 5730 Machine Learning and Artificial Intelligence for Business

Minor in Business Applications and Software Development

The Minor requires 15 credit hours, as follows:

**Required Courses:**

- IS&T 3420 Introduction to Data Science and Management 3
- IS&T 5680 Digital Media Development and Interactive Design

And three courses from the following list: 9

- IS&T 1552 Implementing Information Systems: Data Perspective
- or IS&T 1562 Java and Data Structures
- IS&T 3131 Computing Internals and Operating Systems

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 3
- IS&T 5780 Human and Organizational Factors in Cybersecurity 3
- IS&T 3333 Data Networks and Information Security 3

Two of the following courses must also be taken: 6

- ERP 5240 Enterprise Application Development and Software Security
- IS&T 3420 Introduction to Data Science and Management
- IS&T 4641 Digital Commerce and IoT Analytics
- IS&T 5335 Fundamentals of Mobile Technology for Business

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

Two courses from the following list: 6

- ERP 5410 Use of Business Intelligence
- ERP 5110 Enterprise Resource Planning Systems Design and Implementation
- MECH ENG 5708 Rapid Product Design And Optimization
- MECH ENG 5656 Design For Manufacture
- MECH ENG 5757/ Integrated Product And Process Design
- ENG MGT 5516
- MECH ENG 5763 Computer Aided Design: Theory and Practice

* 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 IoT Analytics 3
- BUS 1414 The Inclusive Workplace 3

Three courses from the following list: 9

- IS&T 5251 Management and Leadership of Technological Innovation
- IS&T 5335 Fundamentals of Mobile Technology for Business
- IS&T 5652 Advanced Web Development
- IS&T 5168 Law and Ethics in E-Commerce
- IS&T 5885 Human-Computer Interaction and User Experience
- IS&T 5886 Prototyping Human-Computer Interactions
- MKT 5310 Digital Marketing and Promotions
- MKT 4580 Marketing Strategy

Minor in Enterprise Resource Planning (ERP)

The minor in ERP requires the following 15 hours of coursework:
The Minor requires 15 credit hours, as follows:

**TRANSFORMATION MINOR**

**Minor in Financial Technology, Analytics and Transformation**

The Minor requires 15 credit hours, as follows:

- **Required Courses:**
  - FINANCE 2150 Corporate Finance I
  - FINANCE 5310 Financial Technology and Analytics

- **One or more of the following courses must be taken:**
  - IS&T 4641 Digital Commerce and IoT Analytics
  - IS&T 5780 Human and Organizational Factors in Cybersecurity
  - IS&T 5820 Data Science and Machine Learning with Python
  - ERP 5210 Performance Dashboard, Scorecard and Data Visualization
  - ERP 5410 Use of Business Intelligence
  - FINANCE 5160 Corporate Finance II
  - FINANCE 5260 Investments I

**MINOR IN FINANCIAL TECHNOLOGY**

**Minor in Human-Computer Interaction and User Experience**

The minor in human-computer interaction and user experience requires the following 15 hours of coursework:

- PSYCH 1101 General Psychology
- IS&T 4654 Introduction to Web Design and Digital Media Studies
- IS&T 5885 Human-Computer Interaction and User Experience

- And two of the following
  - IS&T 4680
  - IS&T 5886 Prototyping Human-Computer Interactions
  - IS&T 5887 Human-Computer Interaction Evaluation

**MINOR IN INFORMATION SCIENCE AND TECHNOLOGY**

The minor in information science and technology requires the following 15 hours of coursework:

- IS&T 1550 Introduction to Management Information Systems
- IS&T 1551 Implementing Information Systems: User Perspective or IS&T 1561 Algorithms and Programming with Java
- IS&T 1552 Implementing Information Systems: Data Perspective or IS&T 1562 Java and Data Structures
- ERP 2110 Introduction to Enterprise Resource Planning

- One other IS&T or ERP course at the 2000 level or above.

**MINOR IN MANAGEMENT**

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

- BUS 1110 Introduction to Management and Entrepreneurship
- BUS 1414 The Inclusive Workplace

- Three courses from the following list:
  - BUS 2910 Business Law
  - BUS 3115 Introduction to Teambuilding and Leadership
  - BUS 5111 Business Negotiations
  - BUS 5150 Customer Focus and Satisfaction
  - BUS 5360 Business Operations
  - BUS 5470 Human Resource Management
  - BUS 5580 Strategic Management
  - BUS 5910 Privacy and Information Security
  - IS&T 4261 Information Systems Project Management
  - ENG MGT 3320 Introduction to Project Management

**MINOR IN HUMAN-COMPUTER INTERACTION AND USER EXPERIENCE**

The minor in human-computer interaction and user experience requires the following 15 hours of coursework:

- PSYCH 1101 General Psychology
- IS&T 4654 Introduction to Web Design and Digital Media Studies
- IS&T 5885 Human-Computer Interaction and User Experience

- And two of the following
  - IS&T 4680
  - IS&T 5886 Prototyping Human-Computer Interactions
  - IS&T 5887 Human-Computer Interaction Evaluation

**MINOR IN INFORMATION SCIENCE AND TECHNOLOGY**

The minor in information science and technology requires the following 15 hours of coursework:

- IS&T 1550 Introduction to Management Information Systems
- IS&T 1551 Implementing Information Systems: User Perspective or IS&T 1561 Algorithms and Programming with Java
- IS&T 1552 Implementing Information Systems: Data Perspective or IS&T 1562 Java and Data Structures
- ERP 2110 Introduction to Enterprise Resource Planning

- One other IS&T or ERP course at the 2000 level or above.

**MINOR IN MANAGEMENT**

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

- BUS 1110 Introduction to Management and Entrepreneurship
- BUS 1414 The Inclusive Workplace

- Three courses from the following list:
  - BUS 2910 Business Law
  - BUS 3115 Introduction to Teambuilding and Leadership
  - BUS 5111 Business Negotiations
  - BUS 5150 Customer Focus and Satisfaction
  - BUS 5360 Business Operations
  - BUS 5470 Human Resource Management
  - BUS 5580 Strategic Management
  - BUS 5910 Privacy and Information Security
  - 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
- or ECON 1200 Principles Of Macroeconomics
- or BUS 1414 The Inclusive Workplace

- MKT 3110 Marketing

- Three courses from the following list:
  - MKT 3210 Consumer Behavior
  - MKT 4580 Marketing Strategy
  - MKT 5310 Digital Marketing and Promotions
  - MKT 5320 Marketing for Non-Profits
  - ERP 4610 Customer Relationship Management in ERP Environment
  - MKT 5410 Big Data Consumer Analytics
  - Other marketing electives approved by the department (MKT 3000 and above)
### Minor in Mobile Business and Digital Transformation

The minor in mobile business and technology requires the following 15 hours of coursework:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>IS&amp;T 4641</td>
<td>Digital Commerce and IoT Analytics</td>
</tr>
<tr>
<td>IS&amp;T 4654</td>
<td>Introduction to Web Design and Digital Media Studies (Two or three of the following courses must be taken.)</td>
</tr>
<tr>
<td>IS&amp;T 5335</td>
<td>Fundamentals of Mobile Technology for Business</td>
</tr>
<tr>
<td>ERP 5240</td>
<td>Enterprise Application Development and Software Security</td>
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</tbody>
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Two or three of the following courses must be taken:

<table>
<thead>
<tr>
<th>Course Code</th>
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<tr>
<td>BUS 1414</td>
<td>The Inclusive Workplace</td>
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<tr>
<td>IS&amp;T 3333</td>
<td>Data Networks and Information Security</td>
</tr>
<tr>
<td>IS&amp;T 5652</td>
<td>Advanced Web Development</td>
</tr>
<tr>
<td>IS&amp;T 5886</td>
<td>Prototyping Human-Computer Interactions</td>
</tr>
<tr>
<td>ERP 4610</td>
<td>Customer Relationship Management in ERP Environment</td>
</tr>
<tr>
<td>ERP 5310</td>
<td>Supply Chain Management Systems in an ERP Environment</td>
</tr>
<tr>
<td>ERP 5210</td>
<td>Performance Dashboard, Scorecard and Data Visualization</td>
</tr>
<tr>
<td>MKT 5310</td>
<td>Digital Marketing and Promotions</td>
</tr>
<tr>
<td>IS&amp;T 5680</td>
<td>Digital Media Development and Interactive Design</td>
</tr>
</tbody>
</table>

Keng Leng Siau, Professor  
PHD University of British Columbia

Sarah Margaret Stanley, Associate Professor  
PHD Saint Louis University

Wen-Bin Yu, Associate Professor  
PHD University of Louisville

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

Wangchu Chu Zhao, Specialist  
MS Missouri University of Science and Technology

Cui Zou, Specialist  
MS Missouri University of Science and Technology

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 1310 Exposure to Computer Experience (LEC 3.0)  
The course provides an overview of simple computing concepts. Students are gently introduced to programming and discuss the impact of computing on society. Students are made aware of various computing-related careers.

IS&T 1311 Exposure to Computing Principles (LEC 3.0)  
Students are introduced to various computing concepts including computer graphics, algorithms, agile development, the world wide web, e-commerce and mobile applications.

IS&T 1312 Computer Programming Exposure (LEC 3.0)  
The course exposes students to principles of programming including variables, data types, expressions, assignment, variables, classes, arrays and other data structures and recursion.

IS&T 1314 Exposure to Cybersecurity Concepts (LEC 3.0)  
This course provides an overview of basic cybersecurity issues, including evaluating of security needs, cryptography, and threat assessment. The course covers a broad array of security topics including data security, network security, security ethics and security as a computing profession. Students are exposed to various industry-standard security tools.

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. Prerequisites: IS&T 1551.
IS&T 1561 Algorithms and Programming with Java (LEC 3.0)
Introduction to programming using Java. Topics include basic
programming concepts such as variable data, decision-making, and
repetitive code. Also algorithm design and analysis, event-driven design
with classes and methods. Numerous programs and group exercises.

IS&T 1561H Algorithms and Prog Java-Honors (LEC 3.0)

IS&T 1562 Java and Data Structures (LEC 3.0)
Provides an intermediate knowledge of programming using Java.
Important concepts of Object Oriented programming will be covered. A
significant part of the course will be devoted to data structures and how
to handle them. Numerous programs will be assigned. Prerequisites: IS&T
1561.

IS&T 1570 Introduction to Management Information Systems (LEC 3.0)
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
datawarehouse, 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 supervisors'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: A grade of "C" or better in IS&T
1562 or IS&T 1552 or Comp Sci 1575.

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: At least Sophomore standing.

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 1562 or
IS&T 1552 or Comp Sci 1575.

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; A grade of "C" or
better in IS&T 1551 or IS&T 1561 or Comp Sci 1570.

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 3131 and either IS&T 1562 or IS&T
1552.

IS&T 3400 Special Problems (IND 0.0-6.0)
Problems or readings on specific subjects or projects in the department.
Consent of instructor required.

IS&T 3401 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 3499 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: A grade of "C" or better in IS&T 1551 or IS&T 1561 or Comp Sci 1570.

IS&T 4444 Introduction to Data Warehouses (LEC 3.0)
This course presents the topic of data warehouses and the value to the organization. It takes the student from the database platform to structuring a data warehouse environment. Focus is placed on simplicity and addressing the user community needs. Prerequisites: IS&T 3423.

IS&T 4450H Introduction to Information Visualization-Honors (LEC 3.0)

IS&T 4641 Digital Commerce and IoT Analytics (LEC 3.0)
Introduction to methods and concepts of data analytics that provides digital marketers and managers the foundation needed to make decisions or detect patterns based on data from eCommerce websites or from Internet of Things (IoT) devices. Key metrics, process, and challenges will be covered. 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 Introduction to Web Design and Digital Media Studies (LEC 3.0)
The course covers web design and digital media, including topics such as social media, cyberculture, service design thinking, citizen journalism, crowd intelligence, brain-computer interfaces, privacy, and copyright.

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: Graduate Standing, strong programming knowledge.

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 Management and Leadership of Technological Innovation (LEC 3.0)
The course covers strategic management of technological innovation and leadership in managing technology-based organizations. It focuses on developing a general management perspective on technology, innovation, industry dynamics of technological innovation, and new product development. Prerequisite: Senior or Graduate Standing.

IS&T 5335 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: Junior standing or above.

IS&T 5420 Business Analytics and Data Science (LEC 3.0)
Analysis of large business data sets via statistical summaries, crosstabulation, 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: Strong programming knowledge required.
**IS&T 5445 Database Marketing** (LEC 3.0)
Intro to methods and concepts used in database marketing: 1) predictive modeling techniques (e.g., regression, decision trees, cluster analysis) and 2) standard processes for mapping business objectives to data mining goals to produce a deployable marketing model. Metrics like lifetime value of a customer and ROI will be covered. Prerequisite: Statistics understanding, programming understanding, familiarity with spreadsheets.

**IS&T 5450 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 5520 Data Science and Machine Learning with Python** (LEC 3.0)
Examines data science methodologies for scraping, manipulating, transforming, cleaning, visualizing, summarizing, and modeling large-scale data as well as supervised and unsupervised machine learning algorithms applied in various business analytics and data science scenarios. Python libraries such as Pandas, NumPy, Matplotlib, and Scikit-learn are utilized. Prerequisites: One of Stat 3111, Stat 3113, Stat 3115, or Stat 3117; one of IS&T 1552, IS&T 1562, Comp Sci 1575; for Graduate Students: knowledge of calculus, statistics, and programming.

**IS&T 5535 Machine Learning Algorithms and Applications** (LEC 3.0)
Introduces techniques of modern machine learning methods with applications in marketing, finance, and other business disciplines. Topics include regression, classification, resampling methods, model selection, regularization, decision trees, support vector machines, principal component analysis, and clustering. R programming is required. Prerequisites: One of Stat 3111, Stat 3113, Stat 3115, Stat 3117; one of IS&T 1552, IS&T 1562, Comp Sci 1575; or Graduate Standing with 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 4654; one of IS&T 1551, IS&T 1561.

**IS&T 5680 Digital Media Development and Interactive Design** (LEC 3.0)
This course covers techniques and tools for design and development of digital and interactive media, including text, graphics, animation, audio, and video. Prerequisites: A grade of "C" or better in IS&T 1551, IS&T 1561 or Comp Sci 1570.

**IS&T 5780 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 5885 Human-Computer Interaction and User Experience** (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 3.0)
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.