

# INFORMATION SCIENCE AND TECHNOLOGY

The Dennis and Janet Jaggi School of Business offers a M.S. in information science and technology (IS&T). Information technology has transformed every aspect of our economy and society. Rapid spread of technology has generated the need for highly trained professionals to implement and maintain information systems and other technologies. The AACSB accredited M.S. in information science and technology is designed to educate students in the design, development, and successful application of information systems and other technologies in organizations. A large number of computing languages and special-purpose software tools are available on various platforms.

## Financial Assistance

Contact Student Financial Services (SFS) at 573-341-4282, sfs@mst.edu or visit <https://sfs.mst.edu/>

## Additional Information

Contact us at 573-341-7216, bit@mst.edu or visit <http://bit.mst.edu>.

## Admission Requirements

In addition to the requirements set by the office of admissions and the office of graduate education, specific requirements for admission to the M.S. in information science and technology (thesis or non-thesis) are as follows:

- Successful completion of a four-year undergraduate degree from a recognized college or university with a GPA (grade point average or international equivalent) of 3.0/4.0 or better.
- Submission of scores from the Graduate Record Exam (GRE) or the Graduate Management Admissions Test (GMAT).
- Undergraduate coursework in Calculus; Statistics; and knowledge of programming language is helpful.

\*\*\*Please note that meeting the above requirements does not guarantee admission into the M.S. in information science and technology, but is used in the admission decision-making process.\*\*\*

## Degree Requirements

**M.S. with thesis:** The M.S. degree with thesis requires the completion of 24 hours of graduate course work (5000-level or above), 6 hours of research, and the successful completion and defense of a research thesis. Courses below the 5000-level will not count toward the M.S. degree, even if they are taken to fulfill prerequisites. 9 credit hours of graduate work (including research) must be at the 6000-level. A minimum of 12 credit hours must be in either IST or ERP courses. Up to 6 credit hours may be taken outside the department with advisor approval if courses are not counted towards a graduate certificate. Up to 12 credit hours may be taken outside the department with advisor approval if courses are counted towards a graduate certificate. A placement examination will be given. See footnote 1 with regard to the placement exam.

**M.S. without thesis:** The M.S. degree without thesis requires the completion of 30 hours of graduate course work (5000-level and above).

Courses below the 5000-level will not count toward the M.S. degree, even if they are taken to fulfill prerequisites. 9 credit hours of graduate course work must be at the 6000-level. A minimum of 12 credit hours must be in either IST or ERP courses. Up to 6 credit hours may be taken

outside the department with advisor approval if courses are not counted towards a graduate certificate. Up to 12 credit hours may be taken outside the department with advisor approval if courses are counted towards a graduate certificate. A placement examination will be given. See footnote 1 with regard to the placement exam.

### Core Courses

IS&T 5420	Business Analytics and Data Science <sup>1</sup>
IS&T 5423	Foundations of Data Management <sup>1</sup>
IS&T 5551	Foundations of Computing and Programming for Data Science <sup>1</sup>
IS&T 6150	Strategic Management Information Systems
IS&T 6336	Internet Computing and the Internet of Things <sup>1</sup>

1. Student will be skills tested before enrollment. If test is passed, student can replace with any 5000 level and above course in BIT.

Students often have difficulty deciding what electives to take. The following sets of courses have been identified as useful for students seeking specialization in particular fields of IST. Note there is no specific recognition of tracks in the degree.

### Project Management, Management, and Leadership Track (choose 5 courses):

- BUS 5115: Introduction to Individual and Group Dynamics in Business
- BUS 5150: Customer Focus and Satisfaction
- BUS 6121: Leadership
- BUS 6425: Supply Chain and Project Management
- ENG MGT 5320: Project Management
- ENG MGT 6322: Case Studies in Project Management
- ENG MGT 6323: Global Project Management
- ERP 5310: Supply Chain Management Systems in an ERP Environment
- IS&T 5251: Management and Leadership of Technological Innovation
- IS&T 6251: Technological Innovation, Entrepreneurship, and Economic Development
- IS&T 6261: Advanced Information Systems Project Management

### Enterprise Resource Planning Track (choose 5 courses):

- ERP 5110: Enterprise Resource Planning Systems Design and Implementation
- ERP 5130: ERP in Small & Mid-Size Enterprises
- ERP 5310: Supply Chain Management Systems in an ERP Environment
- ERP 5410: Use of Business Intelligence
- ERP 6120: Enterprise Resource Planning: Systems Config and Integration
- ERP 6220: Data Modeling & Visualization Prototyping for Enterprise Decision Dashboard

### Analytics, Artificial Intelligence, and Machine Learning Track (choose 5 courses):

- IS&T 5450: Introduction to Information Visualization
- IS&T 5520: Data Science and Machine Learning with Python
- IS&T 5535: Machine Learning Algorithms and Applications
- IS&T 5725: Fundamentals of Cybersecurity Analytics

- IS&T 6443: Information Retrieval and Analysis
- ERP 5410: Use of Business Intelligence
- IS&T 6444: Essentials of Data Warehouses
- MKT 5762: Marketing Revolution with Machine Learning

**General Information Science & Technology Track (choose 5 courses):**

Choose 5 courses not counted as required courses to satisfy overall degree requirements.

The Dennis and Janet Jaggi School of Business offers a variety of graduate certificates. Each certificate program consists of four courses and is open to persons holding a bachelor's, master's or Ph.D degree in areas such as business, social sciences, technology, engineering, or related disciplines who have the required pre-requisites for the courses in the program. A student must maintain an average cumulative grade point of 3.0 or better on a 4.0 scale in the certificate courses in order to receive the graduate certificate.

Students may apply to be admitted only to a graduate certificate program. If admitted, the student will have non-degree graduate status but will earn graduate credit for the courses completed. If a student completes the four graduate certificate courses with a grade of B or better in each of the courses taken, the student may be admitted to the master of business administration or to the master of science in information science and technology if the student so chooses. A student must, however, follow the normal application process and meet other program prerequisites. The graduate certificate credits will count toward the student's MBA or M.S. degree.

The current list of approved graduate certificates includes:

- AI, machine learning and automation in business
- Business analytics and data science
- Business intelligence
- Business project management
- Cybersecurity and information assurance management
- Digital supply chain management
- Enterprise resource planning
- Entrepreneurship and technological innovation
- Finance
- Financial technology, analytics and transformation
- Information system project management
- Management and leadership

Additional graduate certificates may be approved for the department.

Details about some of the graduate certificates are listed below; others are listed in the business administration section of the catalog.

## AI, Machine Learning and Automation in Business

Artificial Intelligence is a disruptive technology in the business realm with transformational impact. From detecting malware and preventing money laundering to automating insurance claims and optimizing inventory and improving product recommendations and more, AI will continue to necessitate changes in core business processes and models. Within the past few years, machine learning, while not fully tapped in the business sphere, has become more effective and widely utilized. Tomorrow's leaders and managers will need to integrate machine learning where

appropriate, incorporating its capabilities with those of humans. The design and implementation of new combinations of technologies with human skills to meet customers' needs will require critical thinking skills, creativity, and project planning.

Required Core Courses:

BUS 5730	Machine Learning and Artificial Intelligence for Business
IS&T 5520	Data Science and Machine Learning with Python
Elective courses (choose two):	
IS&T 5420	Business Analytics and Data Science
IS&T 5535	Machine Learning Algorithms and Applications
IS&T 6443	Information Retrieval and Analysis
IS&T 6723	Artificial Intelligence, Robotics, and Digital Transformation
ERP 6220	Data Modeling & Visualization Prototyping for Enterprise Decision Dashboard

## Business Analytics and Data Science

Data analytics facilitates realization of objectives by identifying trends, creating predictive models for forecasting, and optimizing business processes for enhanced performance. Three main categories of analytics are:

- Descriptive - the use of data to find out what happened in the past.
- Predictive - the use of data to find out what could happen in the future.
- Prescriptive - the use of data to prescribe the best course of action for the future.

Big data is an emerging phenomenon. Computing systems today are generating 15 petabytes of new information every day—eight times more than the combined information in all the libraries in the U.S.; about 80% of the data generated every day is textual and unstructured data.

This graduate certificate is one of three graduate certificates offered by cooperating departments at Missouri S&T to fulfill the needs in the area described as "big data." The other two graduate certificates are:

- Big Data and Security
- Big Data Management and Analytics

Required Core Courses:

IS&T 5420	Business Analytics and Data Science
IS&T 5450	Introduction to Information Visualization
One course from the following:	
BUS 5730	Machine Learning and Artificial Intelligence for Business
IS&T 5520	Data Science and Machine Learning with Python
ERP 5410	Use of Business Intelligence
COMP SCI 5204	Regression Analysis
COMP SCI 5402	Introduction to Data Mining
COMP SCI 6304	Cloud Computing and Big Data Management
COMP ENG 6330	Clustering Algorithms
STAT 5814	Applied Time Series Analysis
One course from the following:	
IS&T 5535	Machine Learning Algorithms and Applications
IS&T 6443	Information Retrieval and Analysis
IS&T 6444/ ERP 6444	Essentials of Data Warehouses
ERP 5210	Performance Dashboard, Scorecard and Data Visualization
ERP 6610	Advanced Customer Relationship Management in ERP Environment

ERP 6220	Data Modeling & Visualization Prototyping for Enterprise Decision Dashboard
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BUS 6425	Supply Chain and Project Management
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## Business Intelligence

Interest in business intelligence has been a recent strong theme among employers. Medium and large-sized businesses are especially interested.

In order to make appropriate decisions, upper-level administration of an organization needs to draw data together from different systems in order to get a unified picture of the status and performance of an organization and present it in helpful ways. Examples include the development of organizational scorecards, dashboards, and other tools that provide a picture of how an organization is performing. People capable of creating and maintaining such information are needed.

This graduate certificate focuses on the technologies that allow an organization to make effective business decisions based on operational data pulled together from many different sources inside and organization. The target audience consists of any individual who would manage any type of IT professionals, database administrators, business analysts, and any person who would need to understand the technologies and their capabilities.

A student admitted to this graduate certificate must complete four courses:

Required core courses:

ERP 5410	Use of Business Intelligence
IS&T 6444/ ERP 6444	Essentials of Data Warehouses

Two courses from the following list:

ERP 5110	Enterprise Resource Planning Systems Design and Implementation
ERP 5210	Performance Dashboard, Scorecard and Data Visualization
ERP 6610	Advanced Customer Relationship Management in ERP Environment
ERP 6220	Data Modeling & Visualization Prototyping for Enterprise Decision Dashboard
IS&T 6443	Information Retrieval and Analysis

## Cybersecurity and Information Assurance Management

Cybersecurity is one of the fastest growing employment segments in IT. As technology grows and progresses, with our devices and lives becoming more and more interconnected, the challenges of cybersecurity and information assurance will continue to grow. This presents a career to those with the necessary skills that will be exciting, rewarding, fast-paced, and highly sought after.

A student admitted to this graduate certificate must complete four courses:

Required Courses:

BUS 5910	Privacy and Information Security
IS&T 5725	Fundamentals of Cybersecurity Analytics
IS&T 5680	Digital Media Development and Interactive Design
IS&T 6336	Internet Computing and the Internet of Things

## Digital Supply Chain Management

Success in today's marketplace requires that organizations deliver products and services that provide easily identified value for their customers. This certificate draws on strengths within two departments

to integrate source (strategic procurement and supply management), production (manufacturing and service operations), and delivery processes (demand fulfillment), with a focus on the use of information technologies as the critical enabler of supply chain efficiencies and responsiveness.

The certificate is designed to give students the tools and ideas that help shape and define the various components of value creation. Students can gain knowledge and skills in the full spectrum of supply chain activities: supplier relationships, purchasing management, operations and inventory management, logistics and transportation, quality management, and information technology.

A student admitted to this graduate certificate must complete four courses:

Required core courses:

ERP 5110	Enterprise Resource Planning Systems Design and Implementation
ERP 5310	Supply Chain Management Systems in an ERP Environment

One course from the following list:

MECH ENG 5708	Rapid Product Design And Optimization
ENG MGT 5614	Supply Chain Management Systems
BUS 6425	Supply Chain and Project Management

One course from the following list:

ERP 5410	Use of Business Intelligence
ERP 6120	Enterprise Resource Planning: Systems Config and Integration
ERP 6610	Advanced Customer Relationship Management in ERP Environment
MECH ENG 5656	Design For Manufacture
MECH ENG 5757	Integrated Product And Process Design
MECH ENG 5760/ AERO ENG 5760	Probabilistic Engineering Design
MECH ENG 5763	Computer Aided Design: Theory and Practice
BUS 5360	Business Operations

## Enterprise Resource Planning (ERP)

Corporations worldwide have focused on improving business processes for the past two decades. In fact, while most Fortune 500 companies have already adopted enterprise resource planning (ERP) systems, now many midsize companies are also planning ERP implementations. With a commitment to keep pace with these changes in business processes and technology, the University of Missouri system joined SAP's™ University Alliance and Microsoft's™ University Alliance programs in order to continue and expand classroom capabilities for integrating ERP software into the curriculum.

ERP systems can be used to reinforce many of the concepts covered in the business discipline. ERP systems incorporate state-of-the-art technology, providing a comprehensive teaching tool for business and for information systems. Universities that have successfully incorporated an ERP system into their curricula find unprecedented student demand for those subjects.

ERP can be viewed as a combination of business management practice and technology, where information technology integrates with a company's core business processes to enable the achievement of specific business objectives. This certificate prepares students for positions as both technical and business consultants in the ERP field.

A student admitted to this graduate certificate must complete four courses:

ERP 5110	Enterprise Resource Planning Systems Design and Implementation
ERP 6120	Enterprise Resource Planning: Systems Config and Integration
Two additional ERP courses at the 5000 level or above, such as:	
ERP 5240	Enterprise Application Development and Software Security
ERP 5210	Performance Dashboard, Scorecard and Data Visualization
ERP 5310	Supply Chain Management Systems in an ERP Environment
ERP 5410	Use of Business Intelligence
ERP 5510	ERP System Administration
ERP 6220	Data Modeling & Visualization Prototyping for Enterprise Decision Dashboard
ERP 6444/ IS&T 6444	Essentials of Data Warehouses
ERP 6610	Advanced Customer Relationship Management in ERP Environment

## Information System Project Management

Managing the development of large software systems is significantly different from managing construction or research projects. However, some of the tools developed for traditional project management continue to have value and can be adapted to development of software.

This certificate aims to equip students with a set of tools that will allow them to achieve Project Management Institute (PMI) standards in the project management area to successfully manage resources, and to analyze, evaluate and improve complex projects.

A student admitted to this graduate certificate must complete four courses:

IS&T 6261	Advanced Information Systems Project Management
ENG MGT 5320	Project Management
ENG MGT 6322	Case Studies in Project Management
ENG MGT 6323	Global Project Management

**Anita Ahl**, Assistant Teaching Professor  
MS Bradley University

**David Bojanic**, Kummer Endowed Professor  
DBA University of Kentucky

**Kris Bruckerhoff**, Assistant Teaching Professor  
MBA, MS, MS St. Cloud State University, St. Cloud State University,  
Kansas State University

**Randy Canis**, Adjunct Professor  
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**Seonjun Kang**, Assistant Professor  
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MS Missouri University of Science and Technology

**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.

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**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.

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**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 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, 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: Strong programming knowledge required.

**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 5551 Foundations of Computing and Programming for Data Science** (LEC 3.0)

An introduction to contemporary computer programming and development with the application focus in the analysis of data in business context. This course aims to provide an overview of the fundamental knowledge and skills needed for advancing in the areas of information science and technology. Topics include introduction to computing, basic programming instructions, relational databases, and graphical representation of information and data. Prerequisites: Senior or graduate standing.

**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 5725 Fundamentals of Cybersecurity Analytics** (LEC 3.0)

This course presents students with a basic understanding of cybersecurity topics, which span organizational information security policies, data breaches, awareness training, network security, application security, cloud security, data management, business continuity, and the latest cybersecurity issues.

**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 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.

**IS&T 6000 Special Problems** (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

**IS&T 6001 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 6050 Continuous Registration** (LEC 1.0)

Doctoral candidates who have completed all requirements for the degree except the dissertation, and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

**IS&T 6099 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 6150 Strategic Management Information Systems** (LEC 3.0)

This course offers an investigation of how information systems support the competitive strategy of an organization and the roles of information systems in transforming organizations and industries. Topics covered include: The firm in its environment; software and hardware components of functional information systems; network and database technology; the systems approach; strategic planning and issues; information resource management; and their impacts on performance and productivity in an organization. Prerequisites: Graduate Standing.

**IS&T 6251 Technological Innovation, Entrepreneurship, and Economic Development** (LEC 3.0)

Technological innovation is an important driver of entrepreneurship and economic development. The course covers essential practices, methods, and tools for successful innovation and entrepreneurship to enhance economic development.

**IS&T 6261 Advanced Information Systems Project Management** (LEC 3.0)

Project management principles, first from a general perspective, and then focused specifically on information system application development are explored. Topics include requirements analysis, project scheduling, risk management, quality assurance, testing, and team coordination. Report writing and research literature searches are required. Prerequisites: Strong programming knowledge required.

**IS&T 6336 Internet Computing and the Internet of Things** (LEC 3.0)

The course principally focuses on what's "under the hood" in the Internet. What are the underlying protocols and how do they work? How can constellations of devices (both traditional computing as well as Internet of Things) be configured into networks using the Internet Protocol suite to communicate with each other? Prerequisite: IS&T MS entrance requirements, including solid programming knowledge.

**IS&T 6443 Information Retrieval and Analysis** (LEC 3.0)

Covers the applications and theoretical foundations of organizing and analyzing information of textual resources. Topics include information storage and retrieval systems, web search engines, text mining, collaborative filtering, recommender systems. Students will also learn the techniques with the use of interactive tools such as SAS. Prerequisite: ERP 5410 or statistics knowledge.

**IS&T 6444 Essentials of 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. Project required. Prerequisite: IS&T 5423 or equivalent relational database experience. (Co-listed with ERP 6444).

**IS&T 6450 Information Visualization** (LEC 3.0)

Topics/activities include: the visualization development framework, traditional presentations of data, human perception and aesthetics, colorspace theory, visualization algorithms and software, case studies of modern topology, research into visualization algorithms and implementations in R. Students will produce significant programs and visualizations. Prerequisites: Statistics, Calculus, and Programming Knowledge.

**IS&T 6723 Artificial Intelligence, Robotics, and Digital Transformation** (LEC 3.0)

The course, designed for business executives, covers management of information to revitalize business processes, improve business decision-making, embrace emerging and disruptive technologies, and gain competitive advantages. The course also covers implications of AI, automation, machine learning, and robotics on business and society. MBA core. Prerequisites: Graduate standing. (Co-listed with Bus 6723).