

# Information Systems

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The first fully accredited program of its kind in New Jersey, the Department of Information Systems continues to be a cutting-edge example of NJIT's long history of innovation and digital communication. Its state-of-the-art curriculum, hands-on application designed focus, solid career preparation for project management and business application leadership provide students with the opportunity to research alongside distinguished professors and scholars who are experts in their fields and eager to create, disseminate and apply fundamental knowledge at the intersection of people, information and computing technology.

Business and information systems and Web and information systems degrees are offered at the undergraduate and graduate levels, and there are two rigorous research tracks at the Ph.D. level—data-intensive research and human-centered computing—all taught by a talented award-winning faculty, which have received highly competitive grants, won best paper awards, written books and published extensively in very selective journals.

## NJIT Faculty

### B

Bieber, Michael P., Professor

### D

Deek, Fadi P., Distinguished Professor

Duan, Lian, Assistant Professor

### E

Egan, Richard W., Senior University Lecturer

### H

Hiltz, S. Roxanne, Distinguished Professor Emeritus

### J

Jones, Quentin, Associate Professor

### L

Lin, Lin, Senior University Lecturer

### R

Recce, Michael, L., Associate Professor

### S

Scher, Julian M., Associate Professor Emeritus

### T

Tremaine, Marilyn M., Professor Emeritus

Turoff, Murray, Distinguished Professor Emeritus

### W

Williams, Keith A., University Lecturer

Wu, Yi-Fang, Brook, Associate Professor

### X

Xu, Songhua, Assistant Professor

## Programs

- Business & Information Systems - B.S. (<http://catalog.njit.edu/undergraduate/computing-sciences/information-systems/business-information-systems-bs/>)
- Human-Computer Interaction - B.S. (<http://catalog.njit.edu/undergraduate/computing-sciences/information-systems/human-computer-interaction-bs/>)
- Information Systems - B.A. (<http://catalog.njit.edu/undergraduate/computing-sciences/information-systems/ba/>)
- Web & Information Systems - B.S. (<http://catalog.njit.edu/undergraduate/computing-sciences/information-systems/web-information-systems-bs/>)

## Double Majors (<http://catalog.njit.edu/undergraduate/academic-policies-procedures/special-degree-options/>)

- Science, Technology and Society/Business and Information Systems - B.S. (<http://catalog.njit.edu/undergraduate/computing-sciences/informatics/science-technology-society-business-information-systems-bs/>)
- Data Analytics (<http://catalog.njit.edu/undergraduate/computing-sciences/information-systems/data-analytics-minor/>)
- Design of the User Experience Minor (<http://catalog.njit.edu/undergraduate/computing-sciences/information-systems/human-computer-interaction-minor/>)
- Business and Information Systems Minor (<http://catalog.njit.edu/undergraduate/computing-sciences/informatics/minor/>) (not for Computing Sciences majors)
- Business and Information Systems Minor (<http://catalog.njit.edu/undergraduate/computing-sciences/informatics/minor-computing-science-majors/>) (for Computing Science majors)
- Mobile and Web Minor (<http://catalog.njit.edu/undergraduate/computing-sciences/information-systems/web-information-systems-minor/>)

## Information Systems Courses

### IS 117. Introduction to Website Development. 3 credits, 3 contact hours (3;0;0).

This course discusses the concepts and skills required to plan, design and build websites. It will be taught in a lab to ensure hands-on experience with each of these tasks. The course begins with an overview of web technologies. Students learn to plan websites, which includes determining the business and end-user requirements for the site. Design includes learning to develop "mockups" of how the site will look and how people will use it. The major tools for building websites will be industry standard HTML and XHTML to describe webpage content, and Cascading Style Sheets (CSS) for flexibly formatting the content. Using XHTML and CSS makes it relatively simple to change formats across the entire site, as well as "future-proofs" a website, allowing it to be viewed on every major web browser (such as Firefox or Chrome) and easily adapt to changes in future browser technology. The course features substantial hands-on projects comprising websites of several interlinked pages and images, enabling students to thoroughly learn the course's important concepts and skills.

### IS 218. Building Web Applications. 3 credits, 3 contact hours (3;0;0).

Prerequisites: (IS 117 or IT 202) and (CS 100, CS 113, or CS 115). This course provides a critical, hands-on introduction to the design of Web-based Information Systems. We will explore and discuss emerging trends, capabilities, and limitations of web technologies used to capture, store, access, and disseminate information for both businesses and online communities. Students, working in groups, will design and develop different types of web applications, which will then be analyzed and critiqued by the students as to their usability in actual public and private settings. An open-source web content management system will be utilized throughout the course.

### IS 219. Adv Website Development. 3 credits, 3 contact hours (3;0;0).

Prerequisites: (IS 117 or IT 202) and (CS 100, CS 113, or CS 115). IS 218 is strongly encouraged as additional foundation knowledge. This course discusses the concepts and skills required to plan, design and build advanced websites, with a focus on sophisticated user interaction enabled by programming the web browser (such as Internet Explorer or Chrome). Such programming is known as client-side scripting. These interactive websites utilize forms to gather user inputs, and vary both the content and display of the webpages based on the current user tasks and preferences. This includes designing and dynamically changing tabs and menus, as well as expanding and contracting sections of pages. Students will develop a thorough understanding of website usability (designing effective sites that people like, security and user privacy, browser capability (ensuring websites work on every major web browser), and the tools and skills that web developers use to add interactive features to websites. These skills include Javascript (for programming interactive features), the Document Object Model or DOM (specifying the internal structure of web pages), JQuery (to access information utilizing this internal structure, create animations and generally streamline Javascript), browser variables (providing information about the browser characteristics), HTML input forms, form validation (ensuring correctness of user input), securing user input (to ensure user privacy), cookies (tracking user information), basic communication with the web server (which processes the information users input into forms), and AJAX ( which integrates many of these technologies). The course will be taught in a lab to ensure hands-on experience and will include substantial design and development projects.

### IS 245. Information Technology Systems: Hardware/Software. 3 credits, 3 contact hours (3;0;0).

This course reviews hardware/software technologies in order to enable system developers to understand tradeoffs in the design of computer architectures for effective computer systems. Also covered are operating systems and systems architecture for networked computing systems. Topics include Hardware (CPU architecture, memory, registers, addressing modes, busses, instruction sets, multi processors versus single processors, and peripheral devices), Operating systems (processes, process management, memory and file system management), and Telecommunications (basic network components, switches, multiplexers and media, installation and configuration of multi-user operating systems).

**IS 247. Designing the User Experience. 3 credits, 3 contact hours (3;0;0).**

This course covers the design and evaluation of the human-computer interface in interactive computer systems. Among the topics covered are approaches to interface design such as menus, commands, direct manipulation; screen layout strategies; metaphor models; models of human information processes; evaluation approaches such as protocol for analysis, interactive monitoring, use of surveys; and requirements for documentation and help. Students are expected to design interface mockups and evaluate them.

**IS 257. Design Thinking: Addressing Structural Inequality. 3 credits, 3 contact hours (3;0;0).**

In this class, students are taught how to think like a designer. The class teaches students design thinking skills in the domain of information and computing. It leverages multiple forms of active learning, involves a significant amount of project-based learning, and helps students develop creative confidence. Students will identify and examine issues related to 'information gaps' which contribute to structural inequality. They will ideate, prototype, and iterate on designs to address these issues. Students will deliver a pitch video describing their idea(s).

**IS 265. Introduction to Information Systems. 3 credits, 3 contact hours (3;0;0).**

Information systems is the study of how organizations use information technology. This course is an overview of the information systems discipline, the role of information systems in organizations, and the changing nature of information technology. Computer tools for analysis and presentation are used. Students receiving degree credit for IS 265 cannot receive degree credit for MIS 245.

**IS 270. Designing the Multimedia Experience. 3 credits, 3 contact hours (3;0;0).**

Prerequisite: Completion of 100 level course in the computing sciences: CS 101 or CS 111 or CS 113 or CS 115 or IS 118. Multimedia combines text, graphics, sound, video, and animation in a single application. Preparation for creating multimedia information systems, and understanding the crucial issues involving technology, design and effectiveness of multimedia applications. Programming techniques for integrating video, sound, animation, and graphics, and design strategies for multimedia information systems.

**IS 310. Co-op Work Experience I. 3 credits, 3 contact hours (0;0;3).**

Prerequisites: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the Co-op office. Mandatory participation in seminars and completion of a report. Note: Normal grading applies to this COOP Experience.

**IS 322. Mobile Applications: Design, Interface, Implementation. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: IS 218, IS 219, or IT 202. This course is a practical introduction to building applications for mobile devices. The course combines hands on design and development experience, with a conceptual overview and discussion of design and practical development issues. Taken into account will be constraints and requirements of devices with small screen sizes, limited battery power, limited computational power, etc. Tools used for building an application in the context of a specific device such as iPhone or an Android based device will be discussed. Students build a mobile application to demonstrate their understanding of mobile web constraints and tools.

**IS 331. Database Design Management and Applications. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: IS 218 or IT 202. Businesses use databases extensively for analysis and decision-making because they provide efficient, large-scale information storage and rapid retrieval. Databases support the "back end functionality" of most large web systems. This course gives students extensive, pragmatic experience in designing, building, querying, updating, maintaining and managing relational databases, using the Structured Query Language (SQL). Proper database design principles are emphasized throughout the course, beginning with high level descriptions of relational databases using data modeling tools (such as entity-relationship or ER diagrams) and progressing to relational database design principles based on higher order normalizations. We will examine some poorly designed databases and show how these can be transformed into well designed databases. SQL will be extensively covered, and students will design and implement sophisticated SQL queries invoking self-joins, outer joins, correlated subqueries and related concepts. Students will explore and utilize design methodologies for input data validation and maintaining database integrity, and study issues of database privacy and security. Advanced topics to be discussed include the role of the Database Administrator (DBA), database life cycle activities, database denormalization, read-only databases and data warehouses. Hands-on experience will be gained by working with actual databases using industry-standard database management systems such as Oracle. A student receiving degree credit for IS 331 cannot receive degree credit for CS 331.

**IS 333. Social Network Analysis. 3 credits, 3 contact hours (3;0;0).**

Prerequisite: Completion of computing GUR (CS 100, CS 101, CS 103, CS 104, CS 111, CS 113, CS 115 or BNFO 135) AND statistical GUR (MATH 105, MATH 120, MATH 225, MATH 244, MATH 279, MATH 305, MATH 333, IE 331, ECE 321 or MNET 315). In this intensive hands-on course, students will learn how to design computer programs to "grab" information from social networking systems such as Facebook, and analyze this to reveal useful but hidden information about the users and their interconnections. Since math is the only language that computers understand, the goal of this class is to build connections between the human language one finds in social network postings and profiles, and mathematical formulas. The skills and techniques utilized in the course will prepare students for advanced courses in data mining and business analytics. This course requires basic statistical knowledge and Java programming skills.

**IS 344. Computing Applications in Business. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: MIS 245 or IS 265 or ACCT 115 or ACCT 117 or MGMT 390. A comprehensive overview of the various types of computing applications used by businesses in order to run effectively and efficiently. All the major functional departments within organizations are examined and evaluated to see how applications are integrated to implement "business processes" that flow across department boundaries, and from suppliers to customers. Students will learn to model business situations and the design of applicable software solutions. A full-semester hands-on student project will provide experience in designing solutions to changes in the business environment.

**IS 350. Computers, Society and Ethics. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: GER (CS 100, CS 101, CS 103, CS 104, CS 113, CS 115, or BNFO 135), and any History and Humanities GER 200 level course and ENGL 101. Examines the historical evolution of computer and information systems and explores their implications in the home, business, government, medicine and education. Topics include automation and job impact, privacy, and legal and ethical issues.

**IS 373. Content Management Systems. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: IS 117 or IT 202. This course provides a hands-on introduction to the design and implementation of enterprise-scale web systems built upon web based content management systems (CMS). CMS manage the creation, storage, retrieval, dissemination, and collection of information in order to meet the needs of businesses, organizations and individuals. Students learn to how to create blogs, discussion boards, wiki, intranets, and dynamic websites using popular CMS packages such as Wordpress and Drupal. Throughout the course students learn how to overcome common challenges that impact the design of these systems such as security for multi-user systems, content strategy, marketing and performance.

**IS 375. Discovering User Needs for UX. 3 credits, 3 contact hours (3;0;0).**

What new digital products or services need to be developed? How do you anticipate someone's needs before they do? How do you understand how people interact with products? These are key questions that both interaction designers and start-up entrepreneurs need to answer. It's all about understanding the user. We need to work with users to investigate or "research" their needs and how they interact with the product or service. In this course, we take a deep dive into qualitative user experience (UX) research. UX research is the process of understanding why and how people use products and services. This course will teach you a set of research tools to discover user needs, investigate the user experience, and enhance the user experience by deriving design recommendations. We will cover techniques like ethnography, focus groups, interviewing, and analyzing qualitative data. We will be talking with user experience researchers at major companies and getting involved with actual user research. This practical, hands-on course will give you an insight into the psychology of user behavior and lay the foundation for students who are pursuing careers designing, evaluating, or marketing products for people.

**IS 385. Special Topics in IS. 3 credits, 3 contact hours (3;0;0).**

The study of new and/or advanced topics in an area of information systems and the computing sciences not regularly covered in any other IS course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course.

**IS 390. Requirements Analysis and Systems Design. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: CS 103, CS 113, CS 115, IS 218 or IT 202. A study of the information systems development life-cycle, from the initial stages of information requirements analysis and determination to the ultimate activities involving systems design. Theory, methodologies and strategies for information requirements analysis, including the assessment of transactions and decisions, fact-finding methodologies, structured analysis development tools, strategies of prototype development, and an overview of computer-aided software engineering (CASE) tools. Theory, methodologies and strategies for systems design, including design of user-interfaces, particularly menu-driven and keyword dialogue strategies, and issues in the proper design of computer output.

**IS 392. AI-Driven Text Analytics. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: CS 100 or DS 100, and IS 331 or CS 331 or MIS 385. The Web and other unstructured/semi-structured, hyper-textual, distributed information repositories all have their unique characteristics and require different techniques to better understand them. AI-driven text analytics aims at discovering useful information and knowledge from various types of unstructured textual elements using machine learning, data mining, and artificial intelligence approaches. The outcomes can be used for site management, personalization, customer sentiment analysis, and beyond. Topics covered in this course include crawling, indexing, ranking and filtering algorithms using text and link analysis, applications to search, classification, tracking, monitoring, and Web intelligence. Natural language processing techniques for storage, classification, and topic modeling will demonstrate applications for unstructured data. Most recent developments in Large Language Models (LLMs) and prompt engineering will be discussed as well. Programming assignments give hands-on experience. A group project highlights class topics.

**IS 393. Usable Security and Privacy. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: IT 230 or CS 351 or IS 247. Cybersecurity and privacy incidents are often blamed on people's choices, but what led to these decisions? If we understand the reasons for these failures and how the systems themselves contributed to them, we can create better technologies that help improve people's security and privacy. In this course, we will study how security and privacy decisions are made in the real world, how incomplete or faulty assumptions may cause mistakes to be made, and what it takes to design and develop systems that overcome these issues. The course will synthesize and present important research in security, privacy, and human-computer interaction. In addition, students will learn and practice techniques, which are commonly used by user experience researchers, that will help them independently evaluate the usability of systems.

**IS 410. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).**

Prerequisites: IS 310 or its equivalent, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience as co-op/internship. Mandatory participation in seminars and completion of requirements that include a report and/or project. Note: Normal grading applies to this COOP Experience.

**IS 421. Advanced Web Applications. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: IS 219 and (IS 331 or CS 331). This course focuses on the design, development, and management of cloud-based web information systems, within the context of startup companies and established organizations. Within the course, we examine business, organizational and technical challenges faced by developers, project managers, and the business development professionals that create web-based software products. The course consists of readings, discussions, and a final team project that demonstrates modular design, planned scalability, maintainability, and the creation of a set of organizational processes that supports the continued support and development of the application. Some of the topics covered in the course are: continuous deployment, continuous integration, automated unit testing, modular design, software team management, agile development, Kanban, customer focused development, and the technologies used to scale cloud applications.

**IS 425. Enterprise AI Applications & Infrastructure. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: IS 331 or CS 331 or MIS 385. This advanced course bridges theoretical foundations with practical applications of artificial intelligence in enterprise information systems. Students will learn to develop, deploy, and manage AI-powered solutions that address real business challenges, such as custom ChatGPT-like applications and intelligent document processing. Emphasis is placed on real-time data ingestion, advanced ETL pipelines, and vector database technology, combined with human-in-the-loop (HITL) workflows and cost-quality optimization. Through hands-on labs and projects, students will build enterprise-grade AI infrastructures ready for diverse, large-scale use cases.

**IS 448. Usability & Measuring UX. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: MATH 105 or MATH 120 or MATH 225 or MATH 244 or MATH 279 or MATH 305 or MATH 333 or IE 331 or ECE 321 or MNET 315, and IS 247. Quantitative methods to measure usability and user experience design are presented via a hands-on, practical experience approach. Usability is a key aspect of user experience, reflecting the quality of how users interact with a product or service. Fundamental concepts, including quantitative experiments such as A/B testing and metrics such as Net Promoter Score (NPS) and System Usability Scale (SUS) are covered. Students will design, conduct, and analyze surveys to assess usability and user experience and apply descriptive and inferential statistics to interpret and communicate results.

**IS 455. IS Mgmt & Business Processes. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: (IS 265 or MIS 245) and IS 390. This course will emphasize how information systems enable core and supportive business processes, as well as those that interface with suppliers, partners and customers. It will discuss basic administrative, management and policy issues associated with the impact of information systems on the user and organization. The second part of the course looks at business processes in organizations: what the business process view is and why it is important, how information systems can improve processes, and how Enterprise Resource Planning systems help with that improvement. Hands-on use of a major ERP system (SAP) is included.

**IS 461. Systems Simulation. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: completion of a 100-level GUR course in computing; MATH 333. This course introduces computer simulation as an algorithmic problem solving technique. Includes discrete simulation models, elementary theory, stochastic processes, use of simulation languages, random number generators, simulation of probabilistic processes, design of simulation experiments, validation of models, queueing systems, and applications to the design and analysis of operational systems. The GPSS language is covered in detail.

**IS 465. Data Analytics for Business Information Systems. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: (CS 100 or DS 100), and MATH 105 or MATH 120 or MATH 225 or MATH 244 or MATH 279 or MATH 305 or MATH 333 or IE 331 or ECE 321 or MGMT 116 or MNET 315, and (CS 331 or IS 331 or MIS 385). This course introduces students to the world of business analytics from an information systems perspective, focusing on the application of various data analysis techniques in business practices. We cover a wide spectrum of topics ranging from fundamental statistics to database, data warehouse, data visualization, and data mining, with a special focus on predictive analysis. Being an introductory course, our approach is "shallow and wide", emphasizing on giving students a complete view of the data analytics profession, covering as many different sub-areas as time allows while not diving too deep into any one specific domain. The goal is to serve as a "guided tour" for students to gain knowledge about the different sub-areas of data analytics and understanding of which area is a best fit for their personal developments. More in-depth materials and discussion for each sub-area will be provided upon students' requests. Course topics include the rudiments of probability and random variables, and visualization, data warehousing and OLAP analysis, dashboard, scorecard, data mining algorithms, optimization techniques, DSS and knowledge systems.

**IS 480. Data-Centric AI. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: DS 100 or CS 100, and MATH 105 or MATH 333, and IS 331 or CS 331 or MIS 385, and IS 465 or CS 375. Data-centric AI focuses on the systematic design of data to improve machine learning outcomes, rather than prioritizing the design and optimization of model architectures and their parameters (model-centric AI). In this course, students will learn to enhance data quality, consistency, and relevance to boost model performance—essential skills for real-world AI applications. Course topics may include AI task design and data requirements, data acquisition, data cleaning and quality assessment, data annotation, annotator reliability, active learning, programmatic labeling, confident learning, data augmentation, data synthesis, data balancing, and data monitoring. By the end of the course, students will be able to use modern tools and frameworks to engineer effective datasets and multi-stage training pipelines to improve AI systems.

**IS 485. Special Topics in Information Systems. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: junior standing and/or department approval. The study of new and/or advanced topics in an area of IS not regularly covered in any other IS course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course. A student may register for no more than two semesters of Special Topics.

**IS 486. Topics in Information Systems. 3 credits, 3 contact hours (3;0;0).**

Prerequisites: Same as for IS 485. A continuation of IS 485.

**IS 488. Independent Study in Information Systems. 3 credits, 0 contact hours (0;0;0).**

Prerequisites: Open to students in the Albert Dorman Honors College or to any student who intends to apply to the Informatics Undergraduate Thesis program. Students need approval from the Informatics department and the Informatics faculty member who will guide the independent study. Independent studies, investigations, research, and reports on advanced topics in Informatics. Students must prepare, in collaboration with their faculty mentor and in the semester prior to enrolling in this course, a detailed plan of topics and expected accomplishments for their independent study. This must have the approval of both the department and the faculty mentor. A student may register for no more than one semester of Independent Study.

**IS 489. INFO Undergrad Thesis Research. 3 credits, 3 contact hours (3;0;0).**

Students continue their research in preparation for completing a Research Thesis.

**IS 491. Senior Project - IS. 3 credits, 3 contact hours (0;0;3).**

Prerequisites: IS 331 or CS 331. Restriction: Senior standing. Integration of knowledge and skills gained in previous information systems courses into an individual research project. The project entails investigation of current literature and the design, implementation and evaluation of an information system.