Semester course; 1 credit. Overview of basic computer concepts, the Internet, new technologies and digital security. Topics include but are not limited to computing devices -- hardware and software -- skills for using and evaluating Internet content and security with digital devices. This course provides the foundation in digital technologies to prepare students for other business courses and application software courses in the INFO16X series. Administered as a self-paced course with all online content. Graded as pass/fail at 80 percent pass level with on-campus assessment. Purchase of online training/assessment package required.

INFO 161. Digital Literacy: Word Processing Skills. 1 Hour.
Semester course; 1 lecture hour. 1 credit. Presents academic- and professional-level word processing skills. Topics include but are not limited to document preparation and modification, tables and graphic enhancements, collaboration, formatting for research papers, newsletters, forms, and linking to other applications. The course will help students prepare documents to support professional tasks and other VCU course work. Administered as a self-paced course. Graded as Pass/Fail at 80 percent pass level with on-campus assessment. Purchase of online training/assessment package required.

INFO 162. Digital Literacy: Spreadsheets Skills I. 1 Hour.
Semester course; 1 credit. Introduces students to academic and professional spreadsheet skills. Topics include but are not limited to the entering of text, numbers and formulas; formatting; moving; copying; recalculation; retrieving; charting; saving; and printing with introductory coverage of data manipulation. The course will help students prepare analyses, tables and charts to assist with professional tasks and other VCU course work. Administered as a self-paced course. Graded as pass/fail at 80 percent pass level with on-campus assessment. Purchase of online training/assessment package required.

INFO 163. Introduction to Web Page Design and Application Software. 1 Hour.
Semester course; 1 credit. Introduces students to Web page design and construction using application software. Topics include Web page creation and modification, hypertext links, tables, graphics, and website organization. Graded as pass/fail. Administered as a self-paced, computer-aided instructional course.

INFO 165. Digital Literacy: Spreadsheet Skills II. 1 Hour.
Semester course; 1 credit. Presents intermediate-level academic and professional spreadsheet skills. Topics include but are not limited to advanced formulas, statistical and financial functions, multiple worksheet/workbook management, macros and pivot tables. This course is designed for students wanting to advance their previous spreadsheet skills. Administered as a self-paced course with all online content. Graded as pass/fail at 80 percent pass level with on-campus assessment. Purchase of online training/assessment package required.

INFO 166. Digital Literacy: Database Skills. 1 Hour.
Semester course; 1 credit. Introduces students to academic and professional database skills. Topics include but are not limited to creating and editing tables and forms, sorting and filtering data, and generating reports. Administered as a self-paced, online course. Graded as pass/fail at 80 percent pass level with on-campus assessment. Purchase of online training/assessment package required.
INFO 350. Programming. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 202, INFO 250, CMSC 245 or CMSC 255; and MATH 211, both with a minimum grade of C. Object-oriented programming and algorithmic design are introduced using C# and the .NET Framework. Emphasizes building business applications using the .NET Framework Class Library and the components, events and message handling therein. Intermediate Web application development is also covered. Students cannot receive credit for both CMSC 256 and INFO 350.

INFO 360. Business Information Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 160. This course is restricted to students who have completed at least 54 credit hours (junior standing). Provides an understanding of the importance of computer-based information in the success of the firm. Emphasis is on the role of information systems within each of the functional areas of business. Major concepts include data management, decision support and management information systems.

INFO 361. Systems Analysis and Design. 3 Hours.
Semester course; 3 lecture hours. 3 credits. This course is restricted to students who have completed at least 54 credit hours (junior standing). Examines the concepts, tools and techniques used to develop and support computer-based information systems. Systems planning, analysis, design and implementation are covered. Behavioral and model building aspects of systems development are emphasized throughout.

INFO 364. Database Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 202, INFO 250, CMSC 245 or CMSC 255; and MATH 211, both with a minimum grade of C. Enrollment is restricted to students who have completed at least 54 credit hours (junior standing). Designed to prepare students for development of systems involving databases and database management.

INFO 365. Database Administration. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 202, INFO 250, CMSC 245 or CMSC 255; and MATH 211, both with a minimum grade of C. Enrollment is restricted to students who have completed at least 54 credit hours (junior standing). Prerequisite: INFO 364. This course is restricted to students who have completed at least 54 credit hours (junior standing). A focused study of planning methods and techniques required for developing and implementing database systems. Emphasis is placed on the role of database management and its application to internetworking. Emphasis is placed on security, vulnerabilities and controls.

INFO 370. Fundamentals of Data Communications. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 202, INFO 250, CMSC 245 or CMSC 255; and MATH 211, both with a minimum grade of C. Enrollment is restricted to students who have completed at least 54 credit hours (junior standing). Computer networks and data communications. Provides an understanding of the underlying concepts of computer networking. Emphasis is placed on terminology, techniques and issues in networking systems.

INFO 370. M. Advanced Networking and Security. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 350 and 364. This course is restricted to students who have completed at least 54 credit hours (junior standing). A focused study of planning methods and techniques required for developing and implementing database systems. Emphasis is placed on security, vulnerabilities and controls.

INFO 380. Information Engineering. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 350, 364, 370 and 461. The student's behavioral and technical skills developed in listed prerequisite courses are challenged by participating in a team systems development project. Appropriate computer-assisted software engineering tools are used throughout the project, from requirement specification to implementation and testing.

INFO 381. Business Process Engineering. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 350. Concentrated study of planning methods and techniques required for defining, planning, integrating and implementing information technology projects consistent with the organizational strategic plan and mission.

INFO 382. Information Systems Planning and Project Management. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 361. Concentrated study of planning methods and techniques required for defining, planning, integrating and implementing information technology projects consistent with the organizational strategic plan and mission.

INFO 383. Projects in Information Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 350, 364, 370 and 461. The student's behavioral and technical skills developed in listed prerequisite courses are challenged by participating in a team systems development project. Appropriate computer-assisted software engineering tools are used throughout the project, from requirement specification to implementation and testing.

INFO 391. Topics in Information Systems. 1-3 Hours.
Semester course; 1-3 lecture hours. 1-3 credits. Maximum of 3 credits per course; maximum total of 6 credits for all topics courses. Enrollment restricted to students with junior standing. An in-depth study of a selected business topic, to be announced in advance.

INFO 450. Advanced Programming. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 350 with a minimum grade of C. Enrollment is restricted to students who have completed at least 54 credit hours (junior standing). The course covers advanced programming concepts. Topics include pointers, advanced GUI components and the building of multithreaded applications containing reusable components based upon design patterns and advanced data structures. Students cannot receive credit for both CMSC 245/246 and INFO 450.

INFO 451. Advanced Technology for E-business. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: grades of C or better in INFO 350 and 364, and junior standing. Focuses on the technical aspects of developing e-business systems using Web services and Web server controls to build visually interactive and highly responsive Web applications. Students will learn how various XML APIs (processing, messaging and distributed registries) are used under the umbrella of Web services to support the sharing of data and processes for e-business applications. The course will integrate the students' prior knowledge of client-side GUI development with server-side controls, components and behaviors in a multitiered environment that includes database connectivity.

INFO 461. Information Systems Planning and Project Management. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 361. Concentrated study of planning methods and techniques required for defining, planning, integrating and implementing information technology projects consistent with the organizational strategic plan and mission.

INFO 463. Business Process Engineering. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 361. This course is restricted to students who have completed at least 54 credit hours (junior standing). A survey of legacy system re-engineering technologies in which the student becomes familiar with a variety of tools used in practice and has the opportunity to develop applications using these tools under supervision. Selection of technologies is determined each semester.

INFO 465. Projects in Information Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 350, 364, 370 and 461. The student's behavioral and technical skills developed in listed prerequisite courses are challenged by participating in a team systems development project. Appropriate computer-assisted software engineering tools are used throughout the project, from requirement specification to implementation and testing.

INFO 468. Information Engineering. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 361 and INFO 364. This course is restricted to students who have completed at least 54 credit hours (junior standing). A study of information engineering as a model-based, data-centric approach to integrating organizational strategic planning with enterprise information systems development. Involves readings, group discussion and case studies.

INFO 472. Infrastructure Services. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 370 and junior standing. Concepts and principles related to administering and securing information and communication technologies. Topics include management of infrastructure, hosts, applications and network security.

INFO 474. Advanced Networking and Security. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 370 and junior standing. Detailed coverage of the TCP/IP protocol suite and its application to internetworking. Emphasis is placed on security, vulnerabilities and controls.

INFO 491. Topics in Information Systems. 1-3 Hours.
Semester course; 1-3 lecture hours. 1-3 credits. Maximum of 3 credits per course; maximum total of 6 credits for all topics courses. Enrollment restricted to students with junior standing. An in-depth study of a selected business topic, to be announced in advance.
INFO 492. Independent Study in Information Systems. 1-3 Hours.
Semester course; 1-3 credits. Maximum total of 3 credits. Prerequisites: junior or senior standing as a major in a business curriculum and approval of adviser and department chair prior to course registration. Intensive study under supervision of a faculty member in an area not covered in-depth or contained in the regular curriculum.

INFO 493. Internship in Information Systems. 3 Hours.
Semester course; 3 field experience hours. 3 credits. Enrollment restricted to students with senior standing and permission of department chair prior to or during advance registration of the semester of credit. Involves students in a meaningful work experience, typically 20 hours per week, in a setting appropriate to the information systems major.

INFO 609. Data-centric Re-engineering Analysis/Planning. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Teaches methods of monetizing or otherwise valuing intangible data practice-improvement opportunities. Students will participate in a semester-long residency in organizations. Student teams will work closely with CIOs. Each team will evaluate operational effectiveness and/or innovation opportunities and recommend specific approaches and estimated benefits. Participating CIOs will receive a professional business case -- including concrete examples -- for implementing data-centric practices in their organizations.

INFO 610. Analysis and Design of Database Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 364. Designed to prepare students for the development of information systems using databases and database management techniques.

INFO 611. Data Re-engineering. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Teaches the process of reengineering data from current to desired structures. Covers a range of methods, tools and techniques for reverse engineering existing schemas and data structure definitions used as the basis for designing more suitable data structures. Appropriate case tools provide students with practical experience.

INFO 614. Data Mining. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: MGMT 302, SCMA 302, SCMA 524 or permission of the instructor. A data mining process has the goal of discovering nontrivial, interesting and actionable knowledge from data in databases. The course introduces important concepts, models and techniques of data mining for modern organizations. Students gain a deeper understanding of concepts and techniques covered in lectures by doing a practical term project that applies one or more of the data mining models and techniques. Students also are given the opportunity to gain knowledge on the features and functionalities of state-of-the-art data mining software through their preparation of a research report.

INFO 616. Data Warehousing. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 610. Covers important concepts and techniques in the design and implementation of a data warehouse. Topics include the data warehouse architecture, the logical and physical design issues in the data warehousing development process, technical factors (i.e., hardware, client/server technology, data warehousing and DBMS technologies) and implementation considerations (i.e., data extraction, clean-up and transformation tools). Introduces online analytical processing and data mining. Crosslisted as: CISS 616.

INFO 620. Data Communications. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 370. Computer network design, communication line control, and communication hardware and software.

INFO 622. Internet Security Management. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Studies the principles of network security and secure operating systems. Included are topics relating to the use of intrusion detection, intrusion prevention and other related tools.

INFO 630. Systems Development. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 361 and 364. Covers business process and data requirements modeling for information systems, using advanced methods and techniques. Students will gain hands-on experience developing specifications and a functional prototype application with current CASE and development tools.

INFO 632. Business Process Engineering. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Critically reviews business process (re)engineering methods and practices. The discipline of Business Process and Application Architectures and modularization are examined. Issues in the implementation of application support for business processes are discussed. The discussion includes strategy visioning, performance benchmarking, process modeling and analysis, and planning organizational change. State-of-the-art business engineering tool-sets such as SAP Business Engineer and J.D. Edwards Business Engineering tool-sets are extensively used to provide practical experience.

INFO 640. Information Systems Management. 3 Hours.
Semester course; 3 lecture hours. 3 credits. A detailed study of the issues, principles, techniques and best practices in managing information systems and enterprise knowledge as organizational resources. Managing enterprise knowledge and information systems involves taking a disciplined approach to managing the infrastructures and harnessing the collective knowledge capital and brain-power of individuals and organizations. Topics include: IT operations, issues in strategic management, establishing standards and procedures, performance evaluation and benchmarking, hardware and software acquisition, physical environments and security issues, outsourcing and partnerships, personnel, knowledge ontology, meta-knowledge and others.

INFO 641. Strategic Information Systems Planning. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 460 or INFO 661. Focuses on developing, implementing and evaluating strategic plans for corporate information systems. Assesses the role of information systems as a competitive tool. Methods and frameworks for strategic analysis are introduced. Mechanisms for establishing an information systems strategy are presented. Emphasis placed on understanding change management issues in IS planning for organizations.

INFO 642. Decision Support and Intelligent Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: INFO 610 and 630. Focuses on the design and deployment of decision technology of two broad types: decision support systems, which are meant to be employed in an advisory capacity by their human users, and intelligent systems, which are generally designed as autonomous decision agents and so intended to displace human functionaries.

INFO 643. Information Technology Project Management. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 640 or 661 or permission from the director of graduate studies in the School of Business. Provides a clear understanding of project management techniques. Covers aspects of planning, organizing, controlling and implementing IT projects. IT project management processes, project scheduling and links with information systems strategy and change management are explored.
INFO 644. Principles of Computer and Information Systems Security. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 640 or INFO 661. Explores issues related to protecting information resources of a firm. Various tools and techniques useful for assessing CISS security concerns in organizations are introduced. Principles and models for CISS security and security management are presented and selected computer and CISS security topics are introduced. Material is presented and discussed from a management frame of reference. Crosslisted as: CISS 644.

INFO 646. Security Policy Formulation and Implementation. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Course covers aspects of policy formulation and implementation. A security policy is considered as a vehicle for executing good strategy. The course analyzes current problems with security strategy formulation and compliance. The content and context of security policies is evaluated to ensure effectiveness.

INFO 654. Systems Interface Design. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 640 or 661. Analyzes factors important in designing the interface for business information systems. Includes designing and developing systems for the Internet. Requires students to work in teams to produce prototype interactive systems.

INFO 658. Securing the Internet of Things. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: INFO 660 or INFO 640. Overviews the emerging field of the Internet of Things with emphasis on how information infrastructure and networks will change the exchange of goods and services in a socially connected world. Specific topics include technological (including hardware/software) infrastructures, types of IoT applications, key IoT policy issues and future trends, IoT security, and privacy challenges in a socially connected world.

INFO 661. Information Systems for Managers. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Provides an understanding of the importance and role of information systems in modern business decision making. Emphasizes choices about information technology and managing projects.

INFO 664. Information Systems for Business Intelligence. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Provides students with techniques and practices for modern decision-making in support of business/corporate performance. Includes hands-on experience with various information analysis, business intelligence and decision support techniques and tools with applications to various business-problem scenarios, such as portfolio analysis, project selection, market research and supply-chain optimization.

INFO 690. Research Seminar in Information Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. This course is designed to provide research experience for candidates not following the INFO 798-799 program.

INFO 691. Topics in Information Systems. 1-3 Hours.
Semester course; 1-3 lecture hours. 1, 2 or 3 credits. Study of current topics. Topics may vary from semester to semester.

INFO 693. Field Project in Information Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Students will work under the supervision of a faculty adviser in planning and carrying out a practical research project. A written report of the investigations is required. To be taken at the end of the program.

INFO 697. Guided Study in Information Systems. 1-3 Hours.
Semester course; 3 lecture hours. 1, 2 or 3 credits. Prerequisite: Approval of proposed work is required by graduate studies office in the School of Business. Graduate students wishing to do research on problems in business administration or business education will submit a detailed outline of their problem. They will be assigned reading and will prepare a written report on the problem. To be taken at the end of the program.

INFO 700. Survey of Information Systems Research. 3 Hours.
Semester course; 3 lecture hours. 3 credits. This course is designed to provide incoming Ph.D. students with an introduction to information systems research. Students will survey various research streams in the field of information systems by familiarizing themselves with the research undertaken by faculty in the IS department. During the semester, students will learn about the various research areas in light of theories that support research and the primary research methods used in these areas. In addition, students will review literature to identify critical research issues in a specific topic area chosen for research and propose solutions to address those issues.

INFO 701. Qualitative Research in Information Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. The course is designed to cover qualitative research published in the information systems discipline and an array of qualitative research methods, including but not limited to grounded theory, positivist case studies, interpretive case studies, hermeneutics, ethnography, action research and interviewing methods. Students will be exposed to the published literature of qualitative research in the IS discipline, as well as to the principles that distinguish qualitative research from other types of IS research. The research methods and techniques will be discussed using published examples of such research. Including a project, the course will help students conduct their own qualitative research.

INFO 702. Design Science Research and Methods in Information Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Enrollment requires permission of instructor. The course is designed to cover design science research published in the information systems discipline and an array of qualitative research methods, including but not limited to grounded theory, positivist case studies, interpretive case studies, hermeneutics, ethnography, action research and interviewing methods. Students will be exposed to the published literature of qualitative research in the IS discipline, as well as to the principles that distinguish qualitative research from other types of IS research. The research methods and techniques used in the various phases of design science research will be discussed using examples from IS analysis and design, database, IS security, decision support and intelligent systems, knowledge management, or other subfields.

INFO 710. Database Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Explores advanced concepts related to management of modern organizations' data resources. Focuses on data administration and the technical aspects of database systems. Some of the database research issues covered include: data quality, design, security, metadata, XML databases and data warehousing. Preparers students for further research into aspects of database systems.

INFO 720. Analysis and Design of Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Covers the philosophical and theoretical foundations of information systems development methodologies and their evolution. Provides an intellectual foundation for students wishing to write a doctoral dissertation in this subject matter. Students will be required to read and analyze articles considered fundamental to the current understanding of the subject.
INFO 730. Information Systems Strategy. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Provides the basis for further Ph.D.-level work in information systems strategy. Covers the theoretical foundations of the subject area. In particular the economic, psychological, sociological and cultural aspects are considered. This focus helps students to identify different research orientations and helps develop an informed opinion on critical research areas.

INFO 740. Decision Support and Intelligent Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Provides the basis for further Ph.D.-level work in decision support and intelligent systems. Explores the theoretical and technical aspects of the subject area. It helps students identify different research orientations with respect to the notion of intelligent systems and build an informed opinion on critical research areas. Explores issues around classes of decision predicates and decision situations. The course also helps students understand technical innovations in decision technologies as they relate to the study of decision support and intelligent systems.

INFO 750. Information Systems Security. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Provides the basis for further Ph.D.-level work in information systems security. Covers the theoretical aspects of the subject area. It helps students identify different research orientations with respect to IS security and build an informed opinion on critical research areas. Explores issues around what IS security is (ontology) and how to acquire the relevant knowledge (epistemology). The course also helps students understand methods of social science research as they relate to IS security.

INFO 760. Knowledge Management. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Explores advanced concepts related to knowledge management and knowledge discovery in modern organizations. Material for the course is drawn from research papers and doctoral dissertations. Requires a high level of student participation, particularly in their critical reviews and presentation of relevant research materials.

INFO 790. Doctoral Seminar. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Open only to Ph.D. students in business. Analyzes and critiques general theories, practices and functions in a specialized area of information systems research.

INFO 798. Thesis in Information Systems. 3 Hours.
Year course; 6 credits. Graduate students will work under supervision in outlining a graduate thesis and in carrying out the thesis.

INFO 799. Thesis in Information Systems. 3 Hours.
Year course; 6 credits. Graduate students will work under supervision in outlining a graduate thesis and in carrying out the thesis.

INFO 898. Dissertation Research in Information Systems. 1-12 Hours.
1-12 credits. Limited to Ph.D. in business candidates.