

INFO & COMMUNICATIONS TECHNOLOGY (ICT)

ICT 4000 ICT Business Essentials for Technology Leaders (4 Credits)

In this course, students will explore the essential attributes of business research and analysis in the Information and Communications Technology (ICT) field to make appropriate business decisions. Students will individually and in teams explore the economic principles that drive the ICT industry. This course sets the foundation for research, analysis, and critical thinking that will be encountered and required throughout the ICT program. As such, a major component of this course is writing research papers on various ICT topics including economic and technical drivers and challenges, ICT economic principles, and the ICT regulator framework. Additionally, students will participate in collaborative teams as they consider industry trends and customer/user needs during the development process to create a product or service proposal and business case. Lastly, students will have the opportunity to evaluate and utilize management and process tools which will guide class discussions as well as critical thinking and analyses in a structured format. The applicability of these tools extends beyond this course and into the operation and management of an ICT organization.

ICT 4001 Technology Leadership (4 Credits)

This course is designed to give technology students a broader perspective on technology in organizations. The content will focus on bringing students a new set of skills that will enable them to evaluate what it means to be a technology leader. Students will explore how an IT organization establishes a technology vision and strategy and will develop skills such as communicating effectively, building and managing technology teams, managing risk, and technology budgeting. At the end of the ten weeks, students will demonstrate their technology leadership abilities in an executive presentation.

ICT 4005 ICT Technical Essentials (4 Credits)

This course comprehensively reviews the technological foundations of today's ICT industry. The course will provide students with a technical foundation needed for the ICT program. No technology experience is needed prior to taking the course. Topics include knowledge management, big data, artificial intelligence, information security, cloud computing, and other emerging technologies such as Blockchain. The application development process is also briefly reviewed. The course will provide students with an overview of technologies used to translate data into knowledge. The security requirements associated with a variety of information types are introduced, along with the current best practices used in information security.

ICT 4007 Creative Problem Solving and Programming Concepts (4 Credits)

In this course students will develop, or improve upon, their problem-solving skills to analyze problems and create solutions. Students will document their solutions and translate them into running programs written in the enormously popular Python programming language. Students will learn programming concepts including the use of variables, program input and output, flow control, conditionals, interpreter- and code-file-based approaches, and error testing. Students will learn how to set up Integrated Development Environments (IDE) such as Visual Studio Code on their personal computers and/or utilize a Cloud IDE in which they will write programs.

ICT 4010 Enterprise Architecture (4 Credits)

In this course, students will learn how to integrate IT to effectively support business goals. The course examines how enterprise architecture (EA) informs business and technology strategy. The course will explore the basics of EA, such as reference architectures, architecture patterns, and a comparison of EA and other architecture types. Students will also examine the opportunities and limitations of various EA frameworks and will apply the methods and tools of one of those frameworks, TOGAF, to design and document an EA initiative. Additionally, the EA implications of recent ICT trends such as cloud computing, global regulatory compliance, data protection, artificial intelligence, and ICT ecosystems will be explored.

Prerequisite: Recommended ICT 4000, ICT 4005.

ICT 4015 Managing Technology for Strategic Value (4 Credits)

Technology's impact on business organizations is tremendous, and will likely only intensify in the future. While some businesses still view technology as an expense to the bottom line, other organizations use technology to gain a competitive advantage. Considering the impact of technology on smaller or startup companies as well as large corporations, this course will explore concepts, tools and frameworks to understand how technology can be used to inform business strategy. Students will apply current methodologies to case studies and projects to gain insight into business and digital transformation. Topics include digital future, business organization framework, technology financial management, data proliferation, technology risk management, disruptive innovations, and performance measurement. Prerequisite: Recommended ICT 4000.

ICT 4020 Business Forecasting and Planning (4 Credits)

This course includes a wide diversity of skills required in one's professional career. Topics include the importance of accurate planning and scheduling for successful projects, risk/opportunity analysis, resource planning and allocation, building budgets, revenue forecasting, profit and loss statements, balance sheet analysis, the importance of managing customer perceptions and expectations, and the impact of economic issues on project success. Students will develop business analyses, including budgets and business plans, for several increasingly difficult scenarios addressing a range of technology applications and services. The final case study will culminate in a presentation to be given to potential investors, banks, or venture capitalists to secure a commitment for funding for a simulated telecom project. Recommended prerequisite: ICT 4000.

ICT 4025 Technology and Innovation Management (4 Credits)

Leaders of innovative firms build commitment to new directions, re-design structures to support new missions, and transform cultures. This course concentrates on the implementation of business strategy through effective structures and systems. Students will apply key aspects of strategic deployment, including organizational structure, product development, business models, and change management. Those aspects of strategic deployment are combined into a business plan. Students will learn how to effectively communicate business plans to decision-makers and stakeholders. Prerequisite: Required ICT 4000.

ICT 4100 Principles of Project Management (4 Credits)

This course will provide students with practical knowledge, tools, and techniques to become an effective project manager and work successfully within a project team. Students will learn real-world application of foundational concepts and develop skills such as stakeholder management, balancing competing constraints, delivery of value, navigating risks and ambiguity, building and running a high-performance project team, defining scope, managing change, and productive communication strategies. Students will practice classroom concepts through hands-on exercises individually and in teams.

ICT 4105 Project Contracts and Procurement (4 Credits)

This course is designed to provide students with leadership and practical skills in project contracts and procurement. The course covers current trends in the procurement marketplace, including digital transformation, supplier relationship management, sustainability, cyber security and agile processes. Students will gain knowledge of the various elements of the contract and procurement process, including procurement plans, requests for proposal (RFP), Statements of Work (SOW), and various types of contracts. Students will learn project management and negotiating skills, and gain hands-on experience developing a procurement plan, supplier selection criteria, an RFP or other appropriate RFx, and contract terms. Recommended prerequisite: ICT 4100.

ICT 4110 Project Risk and Quality Management (4 Credits)

This course introduces students to project risk and quality management and develops advanced skills in applying the project management tools and techniques learned in ICT 4100. A focused examination of scheduling, cost, quality, and risk management processes using advanced tools and techniques is included. Emphasis is placed on the project planning, execution, and monitoring and controlling processes. This course is on the Project Management Institute's (PMI) certification track. Recommended prerequisite: ICT 4100.

ICT 4115 Project Management Dynamics (4 Credits)

This is an advanced course that applies project management knowledge and skills to identify and analyze a complex project dynamics. Case studies will be used to explore the PMI project domains and project management dynamics. Learning is based on reading case material, the PMBOK Standard, completing project management simulations and the practical application of project management tools and techniques. Students receive hands-on simulation experiences in planning and running projects, and working in learning teams to practice project management roles. Students develop a workable project change management system, exercise project integration and communication skills, and demonstrate the ability to keep an overall project on track. They also demonstrate decision-making skills, with emphasis on making trade-offs based on solid business rationale.

ICT 4155 Strategic Alliances in the Technology Sector (4 Credits)

Strategic alliances are one of the key drivers in today's global economy and they have gradually replaced vertical integration as the chief method of corporate expansion. Business-to-Business alliances provide organizations with a variety of benefits including enhancing the capability of organizations and helping to extract maximum value from available resources. While applicable to any industry, strategic alliances are particularly important in the technology sector. This course defines and discusses the roles of various types of strategic alliances in the technology sector, including informal alliances, partnerships, joint ventures, and outsourcing arrangements. Students will use case studies to explore strategies for managing profitability and leveraging these external business relationships. Students will analyze successful and unsuccessful alliances from the perspective of each alliance participant, 3rd party vendors, customers, and a variety of other stakeholders.

ICT 4170 Agile Techniques and Practices in Project Management (4 Credits)

Agile principles and practices are used across many project domains, each with its own unique characteristics and challenges. As the term implies, Agile techniques for the successful use of Agile project management processes are not static; they are dynamic and continuously evolving. The Agile debate is now turning from the tactical to the strategic. Realizing the full benefits of Agile (e.g., faster time to market, improved responsiveness to customers, higher quality, and greater efficiency), means more than improving project execution. It requires understanding the right place for Agile versus traditional methods within a modern enterprise comprised of multiple teams or groups of teams. This course examines both the Agile processes and practices for delivering projects, how to choose when Agile is appropriate versus Predictive methods, and the cultural challenges encountered when transforming into strategic Agile teams. Recommended prerequisite: ICT 4100.

ICT 4200 Cybersecurity Foundations (4 Credits)

This course will provide students with an understanding of cybersecurity and the importance of implementing sound cybersecurity policies, procedures, and systems. The course is for students who are new to cybersecurity (e.g., newly appointed managers with little cybersecurity experience) or those who need a refresher of cybersecurity fundamentals prior to taking additional courses in the concentration.

ICT 4205 Cybersecurity Management (4 Credits)

This course places students in cybersecurity manager roles to expose them to multiple security viewpoints. Students will interact with the full breadth of cybersecurity dimensions, including people, internal and external organizations, systems, and networks. They will learn how organizations strive to control all possible outcomes and occurrences within defined risk contexts as defined by company Directors. Students walk through the management discipline of cybersecurity, starting with the determination of needs and goals and the application of best practices before moving to the continual maintenance and improvement of an organization's cybersecurity stance. The course will provide students with an understanding of management roles and responsibilities including policy and process oversight, adherence to laws and regulations, cybersecurity program management, and understanding the types of reports created and reviewed by cybersecurity managers (such as reports for a Board of Directors). Prerequisite: Recommended ICT 4200 or practical experience in Information Security Principles and Practices.

ICT 4210 Cybersecurity Policy (4 Credits)

This course will help students understand critical events that shaped the U.S. cybersecurity landscape. Students will explore the impact of international cybersecurity policy such as the European General Data Protection Regulation (GDPR) on U.S. businesses. Students will learn how to analyze new cybersecurity policies and regulations to determine their impact on organizations.

ICT 4215 Cybersecurity Risk Management and Incident Response (4 Credits)

This course covers how to manage cybersecurity risk including mitigating risk, responding to incidents, and incident reporting (in particular when governmental and regulatory agencies need to be notified). This course will also address working with a public relations team and the Board of Directors to create press statements regarding cybersecurity incidents or breaches.

ICT 4220 Cybersecurity Leadership and Strategic Planning (4 Credits)

This course covers senior and strategic cybersecurity management roles and responsibilities, including the supervision and management of workers performing cyber-related and cyber operations work. The course also covers developing policies and plans and advocating for policy changes that support organizational cyberspace initiatives or required changes and enhancements.

ICT 4225 Cybersecurity Audits (4 Credits)

Cybersecurity audits play a key role in addressing today's rapidly changing cyber threat landscape. Executives, including members of the Board of Directors may be required to certify that they have taken reasonable steps to protect information assets. Cybersecurity audits are a primary way to verify that information system and process controls effectively address cybersecurity risks. This course will cover cybersecurity audits, providing aspiring audit professionals with the information needed to manage a comprehensive audit of cybersecurity controls. Recommended prerequisite: ICT 4210.

ICT 4300 Web Enabled Information Systems (4 Credits)

This course is an introduction to the development of modern software systems from the desktop to the cloud. The course examines best practices for software development and introduces the three tiers of software development from the web frontend to the database backend using available tools and software. It covers security issues and best practices related to developing web and cloud applications. This course lays the groundwork for a common understanding of full stack development. This should be the first course taken in: Software Design and Programming and Web.

ICT 4305 Object-Oriented Methods and Programming I (4 Credits)

This is the first of two courses that will present Object-Oriented methodologies and programming concepts using the Java programming language. Students will apply Agile tools and techniques, as well as the Unified Modeling Language (UML) within the software development process. The course examines Object-Oriented concepts such as abstraction, encapsulation, generalization, and polymorphism. Students will exercise these concepts with hands-on programming practice and define testing procedures. Additionally, students will use Integrated Development Tools and determine the role of software design frameworks. Students without any Java experience are recommended to take ICT 4361 Java Programming before taking this class. Recommended prerequisite: ICT 4300.

ICT 4310 Distributed Computing (4 Credits)

This course provides a practical, hands-on introduction to distributed applications and the use of cloud technologies. The course develops students' understanding of application scalability, reliability and virtualization through the design, implementation, and deployment of cloud applications and services. Students will evaluate, recommend, and justify distributed technology solutions based on complexity, reliability and cost. Recommended prerequisites: ICT 4300, ICT 4315.

ICT 4315 Object-Oriented Methods and Programming II (4 Credits)

This is the second of two courses that will present object-oriented methodologies and programming concepts using the Java programming language. Students will apply Agile tools and techniques, as well as the Unified Modeling Language (UML) within the software development process. The course builds on the material from ICT-4305 to create code based on models written using the UML while applying industry standard object-oriented design patterns. Students will learn critical skills in designing inheritance hierarchies, working with object persistence and serialization frameworks and multi-threaded code. Additionally, the course will cover critical topics in privacy and security, including recent legislation such as the GDPR. Prerequisite: ICT 4305.

ICT 4351 .NET Programming with C# (4 Credits)

Students will explore the fundamentals of C# and object-oriented programming by using Visual Studio to develop desktop and web applications, test and debug applications, perform object-relational mapping using Entity Framework, and connect with XML and SQL data sources. Students will identify and describe various .NET components, design issues, development solutions, and package managers, while gaining familiarity with the core .NET languages and CLR execution. Recommended prerequisite: ICT 4305.

ICT 4361 Java Programming (4 Credits)

This course introduces students to the fundamentals of procedural and object-oriented programming, using the Java language. It teaches how to write, run, and debug basic programs before moving to a study of discrete, manageable building blocks that can be composed together to form software of any complexity. It will show how to use Java's built-in tools to load, store, and discover information, both in transient memory and persisted files. Students will interpret and modify sample code, with the help of various online learning aids, and gradually build up the confidence needed to write novel programs based on provided specifications.

ICT 4370 Python Programming (4 Credits)

This course starts with an introduction to Python programming covering basic programming concepts and Python syntax. It then continues to deepen students' knowledge of Python by teaching how to access data (text files, databases and other data storage technologies), and process and manipulate that data. Basics of creating front-end interfaces with Python are covered in order to allow students to produce more intuitive interaction with application users. Beyond core Python libraries, other commonly used Python libraries will also be utilized in the course. The course will focus on good programming practices and solving problems effectively. At the successful completion of the class, students will be able to create a number of different types of projects and execute them in Python, as well as continue learning and applying Python skills to data analytics, GIS and other areas of focus. Recommended prerequisite: ICT 4007 (if student has no prior programming experience).

ICT 4375 Blockchain, Cryptocurrency, and Web3 Foundations (4 Credits)

Novel protocols, tools, and techniques are restructuring the web itself into a more distributed, trusted, and self-managing network than ever before. Welcome to Web3. This course will help students master foundational blockchain concepts and explore Web3 enabling technologies. Students will gain the ability to confidently use decentralized technologies like blockchains, cryptocurrencies, peer-to-peer apps, and more. Furthermore, students will understand how these technologies are being applied in industries around the world and why. Students will gain the ability to critically assess when Web3 technology is advantageous over other solutions both from a technical and economical perspective.

ICT 4390 iOS Application Development (4 Credits)

This course is designed to help students build a solid foundation in programming fundamentals utilizing the Swift programming language. Students will gain practical experience with the tools, techniques, and concepts required to build an iOS app both on their own and as a part of a team. Students will also learn the fundamental user interface design principles that are necessary for creating a meaningful user experience. Prior programming experience is not required for this course, but students must have a Mac/Apple computer.

ICT 4395 Android Application Development (4 Credits)

In the Information and Communications Technology Capstone Seminar, students will apply their cumulative knowledge and skills to create a culminating work that critically addresses a problem in their degree field of study. Students make iterative progress on a capstone project throughout the course that presents a position on a relevant problem, supports the position with academic and professional literature, analyzes the proposed solution, and synthesizes scholarly findings. Primary research will not be conducted. The seminar is structured around collegial discussion and continuous feedback from peers and the instructor. At the end of the course, students will present their capstone project with professional and academic audiences in mind. Prerequisite: Acceptance as a degree candidate, completion of at least 40 quarter-hours (including all core courses) with a cumulative GPA of 3.0 or better. A final grade of B- or better is required in this course to meet degree requirements. Students must complete the Capstone Seminar in one quarter; no incomplete grades are assigned.

ICT 4400 Database Administration (4 Credits)

This course introduces the roles and responsibilities, as well as the critical knowledge and skills, needed to function as a database administrator. The course focuses on Oracle and Microsoft SQL Server RDBMSs and the Oracle NoSQL databases. Database administration covers a range of topics which are covered in this course; installation, configuration, performance tuning, maintenance, and database security. Special focus will be paid to the architecture of the RDBMS and NoSQL systems, using it as the basis of much of the work throughout the course. There will be weekly hands-on lab work that afford students opportunities to gain valuable practical experience in managing databases. This course will function as a introduction to other courses in the Database Design and Administration concentration, which will give students the occasion to study these topics in greater depth. The course will conclude with an examination of the future of the database field, discussing quantum computing, cloud computing and block-chain technology.

ICT 4405 Database Design and Implementation (4 Credits)

In this course, students will focus on database design from a holistic view of a database from inception to implementation. Students will start by exploring the history and evolution of database systems and models and then proceed to hands-on application of database design theory. The course concentrates on the relational database model and the conceptual, logical, and physical phases of database design and development. Entity-relationship modeling, data normalization, and Structured Query Language application are core components of the class. Students will gain hands-on experience with database design concepts and have the opportunity to build a relational database using the foundational principles of database design within the framework of the database life cycle (DBLC).

ICT 4410 Data Warehousing Design (4 Credits)

Data warehouses are one of the most valuable assets an organization can possess to remain competitive in a quickly evolving global marketplace. This course provides students an introduction to the role of data warehouses in effective decision-making based on data for strategic and operational objectives and supporting decision support systems. This course will provide students foundational knowledge and skills around data warehouse design and broad coverage of data warehouse concepts, architecture, data modeling, security, implementation and trends underlying current and future development. Prerequisite: Recommended ICT 4400.

ICT 4415 Database Backup and Recovery with Lab (4 Credits)

This course explores database backup and recovery strategies and tactics using both Oracle and SQL Server database systems. The course will include weekly lab work that will give students an opportunity to gain experience with Oracle and SQL Server databases. Topics include preparing backup, recovery and disaster plans, as well as performing complete and incomplete database recoveries using the Oracle Export/Import utility. Students also work with a SQL Server database, utilizing the SQL Server Management Studio. Students will be assigned a Linux Virtual environment that will be used for all Oracle administration, and they will install a SQL Server database locally that will be used for all SQL Server administration. Prerequisite: ICT 4400.

ICT 4430 Database Security (4 Credits)

As the world has become increasingly data-driven, IT professionals have been forced to dramatically rethink how to protect their most valuable corporate asset, data. This course strives to provide a perspective that intersects several technology disciplines: database administration, web-based application development, and technology management. Taking a defense-in-layers view, Database Security will provide students with an opportunity to gain an understanding of how data is protected from several perspectives. A wide range of database security concepts will be explored, including those specific to the Oracle, MySQL, and Microsoft SQL Server RDBMSs. Students will gain an understanding of the different types of threats and vulnerabilities present in a data-centric world and will develop strategies to protect an enterprise's data footprint.

ICT 4451 Database Programming: Oracle PL/SQL (4 Credits)

This course builds on skills learned in ICT 4405 Database Design and Programming. Students will transform a database schema design into a database application using Oracle's PL/SQL programming language. Topics include advanced SQL DDL, DML, and scripting, PL/SQL constructs, stored procedures, modular design and development (packages), software development processes, views, sequences, cursors, dynamic SQL, and error handling. Using weekly assignments, students will practice different aspects of design and development of database applications. Prerequisite: ICT 4405 or SQL experience.

ICT 4462 SQL Server and T-SQL Lab (4 Credits)

This course provides a comprehensive introduction to Microsoft SQL Server, utilizing the SQL Management Studio for administrative and development tasks. This course offers a solid foundation of the Transact-SQL (T-SQL) constructs that will enable students to build, query, maintain, and finetune SQL Server databases. The course focuses on basic to advanced queries including joins, functions, data types, stored procedures, declaration and execution, cursors, temp tables, triggers, error handling, transaction management, and security. This course also offers an introduction to common administrative and maintenance tasks, SQL Integration Services, SQL Analysis Services, and SQL Reporting Services are covered. Working in Microsoft SQL Server, students experience hands-on learning in weekly labs to prepare them for real-world situations. Prerequisite: Recommended ICT 4400.

ICT 4485 NoSQL Databases for Big Data (4 Credits)

Structured Query Language (SQL) based database management systems (DBMS), commonly referred to as relational databases, have been dominant in the market for over forty years and remain so today. However, the emergence of real-time streaming data from technologies such as the Internet of Things (IoT) and relationship-based dynamic datasets from e-commerce and social networks gave rise to big data. Big data is characterized by volume (petabytes), velocity (data rate), and variety (structured and unstructured). Relational databases are not suitable for big data. The requirements of big data have created the need for alternate databases. NoSQL databases were developed to address the requirements of big data. The requirements of big data cannot be satisfied by a single NoSQL database model because real-time streaming data is structured very differently from relationship-based dynamic data. Many large, well-known companies use different types of NoSQL databases to solve problems in their domain. In this course we will examine four NoSQL database models: key-value, document, column, and graph. Students will learn about advantages and disadvantages of each type of NoSQL database model. The course will include hands-on experience with a relational database and each type of NoSQL database. Students will also learn to analyze the structure of data and select the appropriate NoSQL database model to store and manipulate big data.

ICT 4505 Website Design and Management (4 Credits)

This course extends your web design and development skills and includes advanced HTML techniques and enhanced page design capabilities using CSS. The key to great web design is rooted in a solid foundation, which requires a plan or a "blueprint." We will explore best practices in information architecture (IA) and how to incorporate user-centered design (UCD) techniques as a standard practice in web design. Students will also develop an understanding and working knowledge of Cascading Style Sheets. Through the use of readings, examples, hands-on projects, and discussions, the class will build an understanding of the foundations and applications of user-centered design to plan, build, and manage a website. Through participation in a project and regular discussions, class members will experience working as active and contributing members of the class and knowledge-building community. Recommended prerequisite: ICT 4300.

ICT 4510 Advanced Website Design and Management (4 Credits)

Web development has become an integral part of the tech industry and has created a multitude of career options for job seekers. This course will enhance the knowledge gained in ICT-4505 by delving into HTML5 JavaScript APIs and Responsive design using a common CSS framework. Students will be introduced to beginner, intermediate and advanced JavaScript concepts. Finally, the foundational web languages HTML5, CSS and JavaScript will be used to build a fully functional client-side application. Prerequisite: ICT 4505.

ICT 4515 Usability Design for Websites (4 Credits)

This course expands on the basic knowledge of website design and development by providing an in-depth understanding of how to design a website with the user in mind. Students will gain knowledge about how the fields of human factors engineering and psychology (e.g., visual perception, attention, cognition, learning and memory, information processing) relate to the basis of usability design as well as how usability assessments are conducted. Usability guidelines for common functions such as web navigation, search, menus, scrolling, links, text, page layout, visual organization, etc. will be explored. Students will have the opportunity to develop a website that demonstrates appropriate use of important usability guidelines and conduct usability assessments with real users. Prerequisite: ICT 4505.

ICT 4540 Data in Web Application Development (4 Credits)

XML is an open, text-based markup language (Extensible Markup Language) that provides structural and semantic information to data. XML was designed to store and send data, and it can also be used by software and web-based applications for display. This course explores several common industry-leading approaches, models, and techniques for XML in business applications. Hands-on experience with the XML formats and manipulation, which includes syntax, structure, context, and programmatic uses of XML, form the weekly assignments, culminating in a summary project. Other related standards, such as JSON, are discussed, as well as use of CSS for display of XML data. Some JavaScript is introduced to illustrate the document object model and techniques for integration of data. Prerequisites: Students should have familiarity with constructing HTML web pages and data concepts. Familiarity with data manipulation, APIs, or a programming language will be helpful but not required.

ICT 4560 Web Graphics Production (4 Credits)

This course introduces the fundamental concepts and techniques of digital graphics creation and image processing for both online publication and website interface design using industry-leading tools as well as topics around use policy and considerations of image manipulation in the digital age. Students learn the basics of manipulating, correcting and modifying images, bitmap painting tools, vector drawing tools, typography, masking, web production techniques, and advanced image compositing in hands-on exercises and assignments. Basic integration of images and generated code into a website layout employing CSS is also covered. Experience with tools like Adobe Photoshop is useful but not required.

ICT 4570 Web Scripting with JavaScript (4 Credits)

This course presents students with the principles necessary to design and develop client-side and server-side scripts used to build dynamic websites and applications. JavaScript concepts such as data types, control structures, functions and objects are discussed. Students learn how to write beginner and intermediate scripts. Students will be introduced to frameworks and libraries such as Node.js and Arrow Functions that are used to create interactive and dynamic client-side and server-side applications. Real world examples will be included. Technologies covered in the course include JavaScript/ECMAScript, JSON (a JavaScript-friendly data format), XML (Extensible Markup Language) JavaScript as the J in AJAX, and JavaScript in HTML5 form interaction and validation. Prerequisite: Recommended ICT 4505, ICT 4510.

ICT 4580 Cross-Platform Mobile Application Development (4 Credits)

The mobile device market has grown tremendously over the past few years. Self-contained apps that are focused on one concept account for a large percentage of this growth. This course teaches the basic concepts of developing a mobile application using a framework so that the application runs on different devices. Students will synthesize the basic knowledge of the framework to create building blocks of various tools. They will follow best practices in the development lifecycle of building a mobile application. Students will compare and contrast various frameworks for mobile application projects. They will construct their mobile application that could be deployed across many platforms that use native device APIs and hardware. Prior programming experience recommended.

ICT 4605 Principles of Information Security (4 Credits)

This is a comprehensive Information Systems Security management course covering the eight basic principles of Information Assurance and Information Systems Security. The course follows the Common Body of Knowledge (CBK) convention established by the International Information System Security Certification Consortium, Inc. (ISC)2. This course serves as an introduction to the eight domains of information systems security with the emphasis on management issues. It provides the foundation of information systems security and the methodologies that organizations apply to analyze and achieve their security goals. Students learn about significant computer security laws and regulations, system security engineering, the development of effective security policies, system access controls, network security, encryption and security models. The course also covers specific security measures to include, but not limited to, physical security controls, network security, cloud security, telecommunications, and cryptography. Information covered includes contemporary issues of cybercrime, and business continuity and disaster recovery planning. The course applies a systems approach to security issues to analyze and develop security solutions. All topics are discussed in the context of a total enterprise-wide framework.

ICT 4610 TCP/IP Networks (4 Credits)

This course explores the design, architecture, capabilities, and security of the TCP/IP protocol stack by looking at its history, development, and current applications. The course also explores how TCP/IP has supported the growth of the Internet, Internet of Things (IoT), and next-generation wireless networks and services. The TCP/IP model, standards, and key architectural principles that support data flow are examined through familiarization with the full TCP/IP v4 and v6 protocol suites. Students explore TCP/IP capabilities, addressing/subnetting, performance, and cybersecurity issues. The course also covers security-specific protocols to support secure network communications, user identity protection, and the security aspects of all other protocols. Students will examine secure VPN services and mechanisms for personal and business Internet connectivity. The course concludes with a survey of modern topics including Real-Time Communications and IPv6.

ICT 4615 Identity and Access Management (4 Credits)

Identity is the new security perimeter. Access can be determined based on a persona, a role, or a user type. Identity and Access Management (IAM), then, is the foundation for access to any secured computer resource and must be handled and managed carefully and deliberately. This course will provide students with the skills they will need to succeed at designing and implementing access control mechanisms on networked systems. The course covers the principles and mechanisms that compose an overall IAM system and is based on modern technology that supports Zero Trust, Federated Identity, Role-based Access Controls (RBAC), and Attribute-based Access Controls (ABAC).

ICT 4670 Disaster Recovery and Business Continuity Planning (4 Credits)

This course is an introduction to Disaster Recovery and Business Continuity (DR/BC) Planning. The course examines the steps required to identify mission-critical continuity needs of an organization, analyzes the legal & regulatory requirements for data security, and evaluates the various risks management approaches to identify and quantify business risk associated with business continuity. The course provides students the opportunity to create a Disaster Recover/Business Continuity (DR/BC) plan that incorporates business resumption planning, emergency response & communication, and data/system recovery techniques.

ICT 4680 Principles of Cryptography (4 Credits)

E-commerce has made cryptography a cornerstone of modern information systems security. Cryptology is a core component of all recognized information security certifications; however, it may be the least understood of the information security disciplines. This course focuses on the terminology and concepts needed to understand how cryptographic techniques are used to protect sensitive information. Topics include different types of ciphers (substitution, transposition, block and stream), Digital Signatures and Message Authentication Codes, public key infrastructure (PKI), secure sockets layer (SSL), and network protocols for encryption, among others. Lecture and reading materials are reinforced by hands-on experimentation in a virtual lab environment focused on real-world uses of cryptography. Internet resources are used to tie the course material to current technology trends. No programming experience or advanced mathematical skills are required for this course. Recommended prerequisite: ICT 4605.

ICT 4685 Cloud and Internet Law (4 Credits)

This course explores the legal and technical ramifications and implications created by cloud computing and Internet Law. This course also examines the types of issues and concerns that exist in the US and the world by the dynamic change in software, computer networking, and cloud infrastructure. This rapid change in computer networking, data, information, Internet, and cloud architecture directly impacts governments, companies, and individuals. Issues include how to handle data, information, security, privacy, civil and criminal laws, rules and regulations, contractual agreements, and service-level agreements between parties on many levels from service providers in different states, countries, and parts of the world. It is important that all of these issues are balanced by differing cultural standards and mores from all 50 States, all over our country and all around the world, including the legal (and sometimes not so legal) methods of protecting governments and companies in this ever-changing, "always-connected" world.

ICT 4690 Computer Forensics with Lab (4 Credits)

This course will introduce students to current methods and techniques in computer forensics with a focus on the appropriate procedures for evidence collection and processing. As electronic information increases in its importance and use in the court of law, future investigators need to be able to collect and analyze forensics data from computer systems in support of incident investigations, including e-Discovery, forensic analysis and reporting, evidence acquisition, Internet browser forensics and tracing user and application activities on computing systems. The course is supplemented by hands-on exercises, case studies, and a final culminating assignment. Prerequisites: Required ICT 4605 (unless prior ISS experience), Recommended ICT 4610.

ICT 4695 Application Security (4 Credits)

In this course, students explore the security concepts, principles, and practices that are used to secure software applications throughout the modern software development lifecycle (SDLC). Topics include enhancing the agile/scrum development processes with secure design models and application risk analysis, application lifecycle management, defensive programming, secure DevOps, and AppSec issues with new technology and new consumer devices. Recommended prerequisite: ICT 4605.

ICT 4701 Topics in Information and Communication Technology (4 Credits)

This is an advanced special topics seminar course that may be offered to address a developing concept, an industry trend, or a new technology. The focus is on specialized areas of interest. Topics courses may be used as electives within the Information and Communications Technology degree and certificate programs, and, with advance approval from Academic Director, may substitute for core courses in the degree or certificate program.

ICT 4800 Network Communications and the Internet (4 Credits)

This course focuses on the fundamental concepts and technologies of communications networks and the Internet, including Network Communications theory through the TCP/IP stack, which is the foundation of modern communication systems. The course also emphasizes application of these concepts to the analysis and design of network solutions for various Enterprise and Service Providers requirements. Topics include in-depth analysis of the layered structure of networking protocols, network media, communications standards, LAN and WAN network architectures, in-depth IP routing, and current trends in networking via the Internet. Students will analyze the purpose of network routing protocols, their respective algorithms, and IP addressing. Students will apply critical thinking via discussions of current and future trends in network technology, expanding to IP Services, Network Virtualization, and their role in networking evolution. Prerequisite: Recommended ICT 4005.

ICT 4820 Advanced Network Technologies (4 Credits)

Technological advancements in networking within the last few years are revolutionizing networking concepts for both enterprises and service providers. This course demystifies those latest advancements in network technologies. Topics include in-depth coverage of modern networking elements, network requirements, and network virtualization technologies, including Software Defined Networks (SDN) and Network Function Virtualization (NFV). The course will also explore the latest network technologies' requirements, such as elastic traffic, mobility, ultra-low latency, on-demand bandwidth, and more. Further, students will discuss the motivations behind network softwarization, SDN and NFV components, architecture, protocols, and use cases. The course emphasizes deep understanding, analyses, and evaluation of modern network architectures. Prerequisite: Required ICT 4800.

ICT 4830 Broadband Wireless Networks (4 Credits)

This course examines how Broadband radio technologies are changing to meet the growing demands for autonomous vehicles, smart cities/smart homes using smart IoT devices, cellular communications that deliver consumer entertainment/relevant and specific information content, support remote workers, and online learning. Wireless telecommunications networks are studied with an emphasis on the challenges and the approaches to meet the demands of continually increasing data traffic from devices such as mobile smartphones, tablets, hotspots, smart IoT devices, new emerging technologies like cellular-vehicle-to-everything (C-V2x), as well as broadband services like VOIP and mobile video. Current and dominant wireless telecom technologies and protocols are presented, including 3G, 4G LTE, OFDM, MIMO, Mobile IP, WIMAX, and Wi-Fi. The new 5G NR technology standards and services (eMBB, URLLC, mMTC) will be presented. The wireless telecom industry is studied from standards, carrier, and technology perspectives, with an emphasis on radio networks designed to support key use cases. Prerequisite: Recommended ICT 4835.

ICT 4840 Next Generation Wireless Networks and Services (4 Credits)

The rapid innovation in wireless networks that is at the center of today's ICT industry takes place in the four areas of broadband radio, core and edge networks, wireless services, as well as smart objects. This course focuses on the key next generation technologies at the core network, service, and object layers. First, the role of the Internet Protocol Multimedia Subsystem (IMS) in the core network is examined, which is at the heart of many service provider deployments. At the service layer, this course emphasizes wireless service architecture, including popular applications such as mobile real-time messaging, video, and mobile web services. The production of networks and services through cloud technologies is highlighted. The course also explores The Internet of Things (IoT), which plays a prominent role in modern wireless networks. A case study approach is taken to highlight core use cases from key industries including Smart Cities, the Smart Grid, and Industry 4.0. Finally, wireless product development and operations are examined in the critical context of the conflict between over-the-top (OTT) and network operator ecosystems. Prerequisite: Required ICT 4800.

ICT 4845 Information Systems Security with Lab (4 Credits)

In this course, students are introduced to security concepts that align with the Certified Information Systems Security Professional (CISSP) Common Body of Knowledge (CBK). They are instructed to be critical thinkers in their navigation through the network security landscape. Students focus on real-world examples of both perimeter network security and desktop security, which can be used in any environment, simple or complex. Students have the opportunity to work with a range of network security toolboxes in a hands-on software lab environment. Recommended prerequisites: ICT 4800, ICT 4605.

ICT 4901 Capstone Project (4 Credits)

The Capstone Project provides students the opportunity to research a topic, problem, or issue within their field of study, and work individually with a Capstone advisor. Similar in weight to a thesis, but more flexible, this final project will synthesize and apply core concepts acquired from the program. The student will select an appropriate Capstone advisor who is knowledgeable in the field of study to work closely with and who can guide the research project. Evaluation will be focused on the quality and professionalism of applied research and writing; critical and creative thinking; problem-solving skills; knowledge of research design, method, and implementation; and contribution to the field and topic of study. Please see the Capstone Guidelines for additional details. Prerequisites: A Capstone Proposal that has been approved by both the Capstone Advisor and the Academic Director, acceptance as a degree candidate, completion of at least 40 quarter-hours (including all core courses) with a cumulative GPA of 3.0 or better.

ICT 4902 Capstone Seminar (4 Credits)

In the Information and Communications Technology Capstone Seminar, students will apply their cumulative knowledge and skills to create a culminating work that critically addresses a problem in their degree field of study. Students make iterative progress on a capstone project throughout the course that presents a position on a relevant problem, supports the position with academic and professional literature, analyzes the proposed solution, and synthesizes scholarly findings. Primary research will not be conducted. The seminar is structured around collegial discussion and continuous feedback from peers and the instructor. At the end of the course, students will present their capstone project with professional and academic audiences in mind. Prerequisite: Acceptance as a degree candidate, completion of at least 40 quarter-hours (including all core courses) with a cumulative GPA of 3.0 or better. Students must complete the Capstone Seminar in one quarter; no incomplete grades are assigned.

ICT 4980 Internship (0-4 Credits)

The ICT internship is designed to offer students a practical educational experience in an industry related setting. The internship is an individualized learning experience that is directly related to the knowledge and skills covered in the ICT master's degree program. Students are responsible for finding their own internship site and proposing their internship ideas. University College will send notification to all ICT students if they hear of internship possibilities. Students may also work through the DU career center to explore opportunities for internship experiences. The objectives, activities, responsibilities, and deliverables for the internship are defined in a training plan that is developed by the student jointly with the internship supervisor at the sponsoring organization. The training plan is approved by the academic director. Prerequisites: The student must be unconditionally accepted in the ICT degree program, have completed a minimum of 28 hours of graduate coursework, including at least two core courses, and have earned a GPA of 3.0 or better. Enrollment must be approved by the academic director.

ICT 4985 Industry Innovation Project (1-4 Credits)

Students in this course will participate as a part of a team of cross-discipline students working on an innovation project that is scoped to meet the specific needs of its industry client. Students will have a choice between a variety of project types so that each student can select the industry and team role that best supports their specific area(s) of study. Teams will consist of 4-8 students pursuing a mix of technical, business, and liberal arts degrees. Every project will be led by an experienced industry advisor who will be responsible for managing the project workplan, client engagement, and end product quality. Students will gain direct industry experience in their area of study with an emphasis on innovative thinking, team collaboration, and independent project management skills. Prerequisite: Academic director and academic advisor approval is required. Selection criteria will include academic status and project availability.

ICT 4991 Independent Study (1-4 Credits)

This is an advanced course for students wishing to pursue an independent course of study. The student must be accepted in a degree program, have earned a grade point average of 3.0 or better, obtained the approval of the department director, and have completed the Independent Study form and filed the form with all appropriate offices before registering for the independent study. Independent Study is offered only on a for-credit basis.