

INFORMATION TECHNOLOGY

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A successful career in the Information Technology (IT) industry requires more than just technical expertise; it also requires an integrated understanding of the industry as a whole and its practices, technologies, challenges, and trends. Additionally, given the industry's dynamic nature, successful IT professionals must be flexible and committed to continuous learning. The combination of continuous learning, flexibility, and knowledge and skills are traits employers seek when making hiring decisions in the IT industry. The IT program is designed to give the student a broad understanding of the IT industry and help develop the knowledge and skills needed across the industry, including "professional skills" such as communication, organization, critical thinking, problem-solving, leadership and teamwork. The IT program also provides in-depth knowledge in concentration areas including AI Strategy and Application in IT, Cybersecurity Management, Database Design and Administration, Geographic Information Systems, Information Systems Security, Project Management, Software Design and Programming, Technology Management, and Web Design and Development.

This program prepares students to:

- Demonstrate effective oral, written, and non-verbal communication techniques appropriate to the context and audience in order to effect change
- Apply relevant program theory and principles to formulate clear, evidence-based arguments
- Collaborate appropriately with stakeholders regarding the selection, development, and management of technical solutions to meet business requirements
- Assess the key socioeconomic drivers, technical trends, and ethical concerns that shape global innovation, markets, and competition for technical resources to recommend appropriate strategies aligned with organizational goals
- Employ best practices in the evaluation, definition, architecture, design, development, implementation, and management of technical systems, projects, and solutions to meet industry demands
- Synthesize knowledge of diverse areas of technology that form an interrelated system of infrastructure, applications, data, and management practices to influence the future of information technology

Master of Science in Information Technology with Concentration in AI Strategy and Application in IT

This master's degree concentration is designed for IT professionals and leaders seeking to leverage AI effectively and responsibly for application in industry. This program focuses on providing a working knowledge of AI's capabilities, limitations, and ethical considerations, alongside practical skills for developing AI-driven solutions. It aims to prepare leaders and decision-makers to ethically harness AI strategically to meet organizational goals and adapt to the evolving AI landscape.

This program prepares students to:

- Apply a working knowledge of AI capabilities, limitations, and practical applications in order to develop strategies and adapt to a changing AI environment.
- Evaluate ethical, policy, and governance considerations in order to influence ethically responsible AI practices.
- Analyze the strategic potential of various AI tools and solutions to accomplish organizational goals.
- Develop technical solutions through the application of AI competencies.

Master of Science in Information Technology with Concentration in Cybersecurity Management

The Cybersecurity Management master's degree concentration is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. A master's degree concentration in Cybersecurity Management from College of Professional Studies combines technology, management, and business skills to prepare graduates for an exciting, high-demand career in Information Technology (IT) security.

The Cybersecurity Management concentration is designed to equip students with knowledge of industry best practices and management skills demanded by private and public sector employers in today's rapidly evolving cybersecurity industry. Through hands-on interaction with a set of relevant industry case studies, students will gain knowledge of management tools and principles needed to define, establish, and grow effective and mature cybersecurity management programs for a wide range of organizations. Through experiential learning activities, students will gain an understanding of governance, compliance, regulatory, and business operations domains. These experiences will be enhanced with knowledge of policy and risk management frameworks most relevant to the cybersecurity management profession. The curriculum was designed around the Common Body of Knowledge for CISSP certification developed by the International Information Systems Security Certifications Consortium (ISC)² and supports the National Initiative for Cybersecurity Education (NICE) framework.

Students will be prepared to serve in a range of cybersecurity management and leadership roles to continuously strengthen security postures in a fluid environment of constantly changing human, machine, and state actor threats.

This degree prepares students to:

- Analyze methods to develop and implement cybersecurity management policies and procedures to meet organizational needs based on best practices
- Develop comprehensive cybersecurity risk management capabilities using industry-standard frameworks and best practices
- Plan cybersecurity management oversight and governance through development of strategic cybersecurity policies and plans
- Examine best practices for communicating cybersecurity management issues with Boards of Director and other management leadership teams
- Evaluate methods for performing cybersecurity audits and documenting audit responses

Master of Science in Information Technology with Concentration in Database Design and Administration

The Database Design and Administration master's degree concentration is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults who are current or aspiring database designers and administrators. Students will learn how to design, administer, fine-tune, and maintain databases with a database administration degree, plus develop business acumen that will help them excel in the Information Technology (IT) field. Master's degree students learn from expert instructors who work in the fields in which they teach, providing cutting-edge insight into what is needed to work efficiently and effectively in this sector of IT.

The combination of required and elective courses in the master's degree program covers common database management systems (DBMS) such as SQL Server and Oracle. The program encompasses key database concepts such as database administration and database design. This comprehensive content delivered in a hands-on manner provides both the knowledge and the specific skills needed to put the student on the path to earn key industry certifications for vendor database platforms.

This degree prepares students to:

- Analyze, design, develop, test, deploy, administer and maintain database applications and database security based on industry best practices and end-user requirements
- Apply data modeling, data warehousing, performance tuning, programming, and maintenance utilizing database management systems such as SQL Server and Oracle
- Create plans to solve organizational issues using business management strategies directly related to database administration theories and applications
- Formulate plans for database installation and configuration, maintenance, and backup and recovery

Master of Science in Information Technology with Concentration in Geographic Information Systems

The Geographic Information Systems (GIS) master's degree concentration is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. GIS training prepares students to apply geographic information systems technology to solve real-world problems, whether determining the best location for a new store, analyzing environmental damage, or detecting crime patterns in a city. GIS solutions provide the capability to store, retrieve, and analyze spatial information by combining layers of data to yield valuable understanding of a locale.

As a current or aspiring GIS professional, you will receive applied instruction from professional practitioners who work in the fields in which they teach as you learn to plan, implement, and execute a GIS project through remote sensing, internet mapping, or digital image processing. Also, you will develop a valuable business background with creative, solution-oriented techniques through this versatile program, which emphasizes applied education that will propel your GIS career forward. Students will explore GIS fundamentals at a very hands-on, practical level necessary to succeed in the field of GIS.

This degree prepares students to:

- Analyze the nature of, uses for, and implementation processes for geographic data
- Select appropriate applications of GIS technology to solve spatial problems based on organizational/client needs
- Solve real-world problems through analysis and selection of appropriate GIS tools and processes to address the issues

Master of Science in Information Technology with Concentration in Information Systems Security

The Information Systems Security master's degree concentration is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. A master's degree concentration in Information Systems Security from College of Professional Studies combines technology, management, and business skills to prepare graduates for an exciting, high-demand career in Information Technology (IT) security.

Master's degree students receive applied instruction as they learn to navigate real-world security challenges, such as setting up a secure network, securing servers, and problem-solving hypothetical security situations. Students also garner career-relevant knowledge on related IT subjects to better relate the challenges of the rapidly evolving world of information security and cyber threats to other key trends in the IT industry. To ensure up

–to–the–minute knowledge and skills, the curriculum was designed around the Common Body of Knowledge for CISSP certification developed by the International Information Systems Security Certifications Consortium (ISC)². In addition, the program was developed in collaboration with the Colorado Springs and Denver chapters of the Information Security Systems Association (ISSA), and the courses have been mapped to the Committee on National Security Systems (CNSS) standards. The University of Denver has been designated by NSA/DHS as a National Center of Academic Excellence in Cyber Defense Education.

This degree prepares students to:

- Develop and implement technical information security tools, policies and procedures to meet organizational needs based on best practices
- Analyze security scenarios to design secure network solutions and applications
- Create strategies to establish secure operations, access control methods, and system security to meet organizational/client requirements
- Plan for business continuity based on organizational culture and requirements

Master of Science in Information Technology with Concentration in Project Management

The Project Management master's degree specialty through the Information Technology (IT) program is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. Students will combine information and communication technology skills with a project management and business background and become a proficient leader within the IT field.

Students will receive hands-on, practical instruction from professional practitioners, who work in the fields in which they teach, on the tools and techniques of effective project management. Students will learn how to develop a clear plan that places a project in the context of an organization's strategic plan, while considering the implications information technologies present in any given project.

Graduates of the Project Management program will gain a firm grasp on converging information technologies and learn to understand the fundamentals of each sector. Recognizing how each IT subject connects to one another, from information systems security to software development, will give students the competitive edge needed in this dynamic industry. The content for this concentration has been developed to align with the current edition of the Project Management Institute's (PMI)® A Guide to the Project Management Body of Knowledge, (PMBOK® Guide), Project Management Institute, Inc. The unique curriculum equips students with the information and skills needed for the PMI® Project Management Professional (PMP)® Certification Exam.

This degree prepares students to:

- Apply principles of project management to become proficient in the use of project management software
- Demonstrate the use of agile concepts and techniques to deliver complex projects
- Design a comprehensive risk management plan for a project
- Create strategies to manage the complexity inherent in large-scale projects
- Relate project scope to cost, time, and resource requirements
- Develop procurement plans and assess project contracts

Master of Science in Information Technology with Concentration in Software Design and Programming

The Software Design and Programming master's degree concentration is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. Students will expand their knowledge of software design and programming principles while developing the in–depth skills needed to succeed in the field with a Software Design and Programming master's degree. Current or aspiring programmers will practice both structured and object-oriented methodologies focusing on industry best practices. Students are able to select from a variety of elective courses that best meet their specific Information Technology (IT) career goals.

Students learn how to develop software programs and applications using modern programming languages, current development frameworks, and Software Quality Assurance (SQA) practices. Students learn to select software solution design methodologies that meet requirements such as scalability, reliability, and implementation. With guidance from expert instructors, students learn and apply problem-solving skills while designing and programming software solutions.

This degree prepares students to:

- Design software solutions using best practices in security, Software Quality Assurance (SQA), and current development frameworks
- Apply both structured and object-oriented design methodologies to create robust, reusable software using modern programming languages
- Assess the role of frameworks in software design and development to lay the groundwork for full-stack development
- Examine distributed computing concepts relating to cloud computing—such as scalability, reliability, virtualization, implementation, and deployment—in order to make informed software development decisions

Master of Science in Information Technology with Concentration in Technology Management

The Technology Management master's degree concentration is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. The Technology Management degree concentration represents the convergence of business and technology and emphasizes the impact technology can have on strategic and operational objectives when applied through sound business

management practices. With the right technical skills, combined with a strategic perspective regarding critical business needs, students will be prepared to meet current industry demands, and positioned to meet the demands of tomorrow.

Graduates with a Technology Management master's degree concentration or graduate certificate become proficient in creating, managing, and using technology to accomplish strategic organizational goals as they expand and strengthen their knowledge and skills in creative thinking, strategic and tactical decision-making, and global awareness. In addition to the practical education received online or on campus, Technology Management master's degree students will also receive a broader understanding of how related IT sectors impact their technology management roles.

This degree prepares students to:

- Formulate plans to manage technologies for strategic advantage
- Develop and evaluate business cases based on organizational and client requirements
- Assess the role of strategic alliances within an organization
- Apply project management principles and processes in relation to technology management strategies
- Formulate informed financial decisions and strategic budgets to drive organizational success
- Evaluate strategies and utilize best practices in technology forecasting and innovation

Master of Science in Information Technology with Concentration in Web Design and Development

The Web Design and Development master's degree concentration is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. The program provides an in-depth knowledge of web design and web development through hands-on instruction. Students will move beyond the development of first-generation HTML-based Web pages and learn to create interactive, state-of-the-art, web-based applications. Using a variety of essential software tools students will develop projects that support the demands of contemporary business models. The real-world development scenarios, coupled with the hands-on learning experience provided by professional practitioners who work in the fields in which they teach, result in a highly career-relevant, innovative degree in web design and development. In addition to IT fundamentals, students will also develop essential business and problem-solving skills that will help them thrive in any organization. In an increasingly technological world, it is vital to understand the fundamentals of other areas of the Information Technology (IT) field, and how each converges with web design and web development.

This degree prepares students to:

- Create interactive web-based applications for business processes and consumer demands using tools such as cascading style sheets, web graphics construction, interface design and usability, web scripting, and databases
- Analyze enterprise goals to apply information architecture and web-design foundational principles for the development of client-server and cloud-based solutions
- Develop solutions for web, app, and mobile scenarios using the latest versions of JavaScript, HTML, CSS, XML, PHP, and Python
- Assess how web design and development converges within the context of security, software, and database design

Graduate Certificate in Information Technology with Concentration in AI Strategy and Application in IT

This certificate is designed for IT professionals and leaders seeking to leverage AI effectively and responsibly for application in industry. This program focuses on providing a working knowledge of AI's capabilities, limitations, and ethical considerations, alongside practical skills for developing AI-driven solutions. It aims to prepare leaders and decision-makers to ethically harness AI strategically to meet organizational goals and adapt to the evolving AI landscape.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Graduate Certificate in Information Technology with Concentration in Cybersecurity Management

The graduate certificate in Cybersecurity Management is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. A graduate certificate in Cybersecurity Management from College of Professional Studies combines technology, management, and business skills to prepare graduates for an exciting, high-demand career in Cybersecurity Management.

Certificate classes at College of Professional Studies are designed to equip students with knowledge of industry best practices and management skills demanded by private and public sector employers in today's rapidly evolving cybersecurity industry. Through hands-on interaction with a set of relevant industry case studies, students will gain knowledge of management tools and principles needed to define, establish, and grow effective and mature cybersecurity management programs for a wide range of organizations. Through experiential learning activities, students will gain an understanding of governance, compliance, regulatory, and business operations domains. These experiences will be enhanced with knowledge of policy and risk management frameworks most relevant to the cybersecurity management profession. The curriculum was designed around the Common Body of Knowledge for CISSP certification developed by the International Information Systems Security Certifications Consortium (ISC)2 and supports the National Initiative for Cybersecurity Education (NICE) framework.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Graduate Certificate in Information Technology with Concentration in Database Design and Administration

The graduate certificate in Database Design and Administration is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults who are current or aspiring database designers and administrators. Certificate students will expand their skillsets to include designing, administering, fine-tuning, and maintaining databases with a graduate certificate in database design and administration concentration. Expert instructors who work in the fields in which they teach provide excellent insight to what is needed to work efficiently and effectively in this sector of IT.

This certificate prepares students to become leaders in database design, development, and administration while expanding their skillsets to include data modeling, data warehousing, performance tuning, programming, and building and maintaining client-server databases. The combination of required and elective courses in the master's degree program covers common database management systems (DBMS) such as SQL Server and Oracle. The program encompasses key database concepts such as database administration and database design.

This comprehensive content delivered in a hands-on manner provides both the knowledge and the specific skills needed to put the student on the path to earn key industry certifications for vendor database platforms. Students will also gain additional skills and knowledge in database design and administration through elective coursework. Credits earned through this graduate certificate may apply toward a master's degree in Information Technology.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Graduate Certificate in Information Technology with Concentration in Information Systems Security

The graduate certificate in Information Systems Security is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. A graduate certificate in Information Systems Security from College of Professional Studies combines technology, management, and business skills to prepare graduates for an exciting, high-demand career in Information Technology (IT) security.

Certificate classes at College of Professional Studies use innovative lab experiences to provide hands-on expertise with industry-current security tools. Students also garner career-relevant knowledge on related IT subjects to better relate the challenges of the rapidly evolving world of cyber security and cyber threats to other key trends in the IT industry. To ensure up-to-the-minute knowledge and skills, the curriculum was designed around the Common Body of Knowledge for CISSP certification developed by the International Information Systems Security Certifications Consortium (ISC)². In addition, the program was developed in collaboration with the Colorado Springs and Denver chapters of the Information Security Systems Association (ISSA), and the courses have been mapped to the Committee on National Security Systems (CNSS) standards. The University of Denver has been designated by NSA/DHS as a National Center of Academic Excellence in Cyber Defense Education. Credits earned through this graduate certificate may apply toward a master's degree in Information Technology.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Graduate Certificate in Information Technology with Concentration in Project Management

The graduate certificate in Project Management through the Information Technology program is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. Certificate students will learn to combine information technology skills with a project management and business background and become a proficient leader within the Information Technology (IT) field. Students will receive hands-on, practical instruction from professional practitioners who work in the fields in which they teach on the tools and techniques of effective project management. Additionally, students will learn how to develop a clear plan that places a project in the context of an organization's strategic plan, while considering the implications information and communication technologies present in any given project. Students will also gain additional skills and knowledge in project management through elective coursework.

Project Management concentration students will learn about converging information technologies and the fundamentals of each sector. Recognizing how each IT subject connects to one another, from information systems security to software development, will give students the competitive edge needed in this dynamic industry. The content for this graduate certificate has been developed to align with the current edition of the Project Management Institute's (PMI)® A Guide to the Project Management Body of Knowledge, (PMBOK® Guide), Project Management Institute, Inc. The unique curriculum equips students with the information and skills needed for the PMI® Project Management Professional (PMP)® Certification Exam. Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

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Graduate Certificate in Information Technology with Concentration in Software Design and Programming

The Software Design and Programming graduate certificate is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. Students will expand their knowledge of software design and programming principles while developing the in-depth skills needed to succeed in the field with a Software Design and Programming certificate. Current or aspiring programmers will practice both structured and object-oriented methodologies focusing on industry best practices. Students are able to select from a variety of elective courses that best meet their specific Information Technology (IT) career goals.

Certificate students learn how to develop software programs and applications using modern programming languages, current development frameworks, and Software Quality Assurance (SQA) practices. Students learn to select software solution design methodologies that meet

requirements such as scalability, reliability, and implementation. With guidance from expert instructors, students learn and apply problem-solving skills while designing and programming software solutions.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Graduate Certificate in Information Technology with Concentration in Technology Management

The graduate certificate in Technology Management is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. Certificate students will learn how the convergence of business and technology impacts the strategic and operational objectives. Students will gain the right technical skills, combined with a strategic perspective regarding critical business needs, as they are prepared to meet current industry demands, and positioned to meet the demands of tomorrow.

The Technology Management concentration allows students to become proficient in creating, managing, and using technology to accomplish strategic organizational goals as they expand and strengthen their knowledge and skills in creative thinking, strategic and tactical decision-making, and global awareness. This applied Technology Management certificate offers professionals an opportunity to receive applied instruction from professional practitioners who bring deep expertise in business management strategies and their technological implications. Students will also gain additional skills and knowledge in technology management through elective coursework. Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Graduate Certificate in Information Technology with Concentration in Web Design and Development

The Web Design and Development graduate certificate is offered online or on campus at the University of Denver in the evenings, or in a combination of both, to meet the needs of busy adults. The certificate program provides an in-depth knowledge of web design and web development through hands-on instruction. Students will move beyond the development of first-generation HTML-based Web pages and learn to create interactive, state-of-the-art, web-based applications. Using a variety of essential software tools students will develop projects that support the demands of contemporary business models. The real-world development scenarios, coupled with the hands-on learning experience provided by professional practitioners who work in the fields in which they teach, result in a highly career-relevant, innovative graduate certificate in web design and development. In addition to IT fundamentals, students will also develop essential business and problem-solving skills that will help them thrive in any organization. In an increasingly technological world, it is vital to understand the fundamentals of other areas of the Information Technology (IT) field, and how each converges with web design and web development.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Specialized Graduate Certificate in AI Strategy and Application in IT

This specialized graduate certificate is designed for IT professionals and leaders seeking to leverage AI effectively and responsibly for application in industry. This program focuses on providing a working knowledge of AI's capabilities, limitations, and ethical considerations, alongside practical skills for developing AI-driven solutions. It aims to prepare leaders and decision-makers to ethically harness AI strategically to meet organizational goals and adapt to the evolving AI landscape.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Specialized Graduate Certificate in Cybersecurity Management

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Certificate classes at College of Professional Studies are designed to equip students with knowledge of industry best practices and management skills demanded by private and public sector employers in today's rapidly evolving cybersecurity industry. Through hands-on interaction with a set of relevant industry case studies, students will gain knowledge of management tools and principles needed to define, establish, and grow effective and mature cybersecurity management programs for a wide range of organizations. Through experiential learning activities, students will gain an understanding of governance, compliance, regulatory, and business operations domains. These experiences will be enhanced with knowledge of policy and risk management frameworks most relevant to the cybersecurity management profession. The curriculum was designed around the Common Body of Knowledge for CISSP certification developed by the International Information Systems Security Certifications Consortium (ISC)² and supports the National Initiative for Cybersecurity Education (NICE) framework.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Specialized Graduate Certificate in Database Design and Administration

Students in this specialized graduate certificate will expand their skillsets to include designing, administering, fine-tuning, and maintaining databases with a graduate certificate in database design and administration concentration. Expert instructors who work in the fields in which they teach provide excellent insight to what is needed to work efficiently and effectively in this sector of IT.

This certificate prepares students to become leaders in database design, development, and administration while expanding their skillsets to include data modeling, data warehousing, performance tuning, programming, and building and maintaining client-server databases. The program

encompasses key database concepts such as database administration and database design. This extensive content delivered in a hands-on manner provides both the knowledge and the specific skills needed to put the student on the path to earn key industry certifications for vendor database platforms. Credits earned through this certificate may apply toward a master's degree in Information Technology.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Specialized Graduate Certificate in Information Systems Security

A specialized graduate certificate in Information Systems Security from College of Professional Studies combines technology, management, and business skills to prepare graduates for an exciting, high-demand career in IT security.

Certificate classes at College of Professional Studies use innovative lab experiences to provide hands-on expertise with industry-current security tools. Students also garner career-relevant knowledge on related IT subjects to better relate the challenges of the rapidly evolving world of cyber security and cyber threats to other key trends in the IT industry. To ensure up-to-the-minute knowledge and skills, the curriculum was designed around the Common Body of Knowledge for CISSP certification developed by the International Information Systems Security Certifications Consortium (ISC)². In addition, the program was developed in collaboration with the Colorado Springs and Denver chapters of the Information Security Systems Association (ISSA), and the courses have been mapped to the Committee on National Security Systems (CNSS) standards. The University of Denver has been designated by NSA/DHS as a National Center of Academic Excellence in Cyber Defense Education. Credits earned through this certificate may apply toward a master's degree in Information Technology.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Specialized Graduate Certificate in Project Management

Students in the specialized graduate certificate in Project Management will learn to combine information and communication technology skills with a project management and business background and become a proficient leader within the Information Technology (IT) field. Students will receive hands-on, practical instruction from professional practitioners who work in the fields in which they teach on the tools and techniques of effective project management. Additionally, students will learn how to develop a clear plan that places a project in the context of an organization's strategic plan, while considering the implications information technologies present in any given project.

Students will learn about converging information technologies and the fundamentals of each sector. Recognizing how each IT subject connects to one another, from information systems security to software development, will give students the competitive edge needed in this dynamic industry. The content for this graduate certificate has been developed to align with the current edition of the Project Management Institute's (PMI)® A Guide to the Project Management Body of Knowledge, (PMBOK® Guide), Project Management Institute, Inc. The unique curriculum equips students with the information and skills needed for the PMI® Project Management Professional (PMP)® Certification Exam. Credits earned through this certificate may apply toward a master's degree in the Information Technology program.

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Specialized Graduate Certificate in Software Design and Programming

Students in the Software Design and Programming specialized graduate certificate will expand their knowledge of software design and programming principles while developing the in-depth skills needed to succeed in the field with a Software Design and Programming certificate. Current or aspiring programmers will practice both structured and object-oriented methodologies focusing on industry best practices. Students are able to select from a variety of elective courses that best meet their specific Information Technology (IT) career goals.

Certificate students learn how to develop software programs and applications using modern programming languages, Software Development Life Cycle (SDLC) frameworks, and Software Quality Assurance (SQA) practices. Students learn to select software solution design methodologies that meet requirements such as scalability, reliability, and implementation. With guidance from expert instructors, students learn and apply problem-solving skills while designing and programming software solutions.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Specialized Graduate Certificate in Technology Management

Students in the specialized graduate certificate in Technology Management will learn how the convergence of business and technology impacts the strategic and operational objectives. Students will gain the right technical skills, combined with a strategic perspective regarding critical business needs, as they are prepared to meet current industry demands, and positioned to meet the demands of tomorrow.

The Technology Management certificate allows students to become proficient in creating, managing, and using technology to accomplish strategic organizational goals as they expand and strengthen their knowledge and skills in creative thinking, strategic and tactical decision-making, and global awareness. This applied Technology Management certificate offers professionals an opportunity to receive applied instruction from professional practitioners who bring deep expertise in business management strategies and their technological implications. Credits earned through this certificate may apply toward a master's degree in the Information Technology program.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Specialized Graduate Certificate in Web Design and Development

Students in the Web Design and Development specialized graduate certificate gain in-depth knowledge of web design and web development through hands-on instruction. Students will move beyond the development of first-generation HTML-based Web pages and learn to create interactive, state-of-the-art, web-based applications. Using a variety of essential software tools students will develop projects that support the demands of contemporary business models. The real-world development scenarios, coupled with the hands-on learning experience provided by professional practitioners who work in the fields in which they teach, result in a highly career-relevant, innovative certificate in web design and development. In addition to IT fundamentals, students will also develop essential business and problem-solving skills that will help them thrive in any organization. In an increasingly technological world, it is vital to understand the fundamentals of other areas of the Information Technology (IT) field, and how each converges with web design and web development.

Credits earned through this graduate certificate may apply toward a master's degree in the Information Technology program.

Master's Degree Admission

Degree and GPA Requirements

Bachelor's degree: All graduate applicants must hold an earned baccalaureate from a regionally accredited college or university or the recognized equivalent from an international institution.

University GPA requirement: The minimum grade point average for admission consideration for graduate study at the University of Denver must meet one of the following criteria:

- A cumulative 2.5 on a 4.0 scale for the baccalaureate degree.
- A cumulative 2.5 on a 4.0 scale for the last 60 semester credits or 90 quarter credits (approximately two years of work) for the baccalaureate degree.
- An earned master's degree or higher from a regionally accredited institution or the recognized equivalent from an international institution supersedes the minimum GPA requirement for the baccalaureate.
- A cumulative GPA of 3.0 on a 4.0 scale for all graduate coursework completed for applicants who have not earned a master's degree or higher.

English Language Proficiency Test Score Requirements

The minimum TOEFL/IELTS/C1 Advanced/Duolingo English Test score requirements for this degree program are:

- Minimum TOEFL Score (Internet-based test): 80 with minimum of 20 on each sub-score
- Minimum IELTS Score: 6.5 with minimum of 6.0 on each band score
- Minimum C1 Advanced Score: 176
- Minimum Duolingo English Test Score: 115 with subscore minimums: Literacy, Comprehension-105; Conversation, Production-115. Tests prior to July 1, 2024: Literacy, Comprehension, Conversation-105; Production 95

Certificate Admission

Bachelor's degree: All graduate applicants must hold an earned baccalaureate from a regionally accredited college or university or the recognized equivalent from an international institution.

University GPA requirement: The minimum grade point average for admission consideration for graduate study at the University of Denver must meet one of the following criteria:

- A cumulative 2.5 on a 4.0 scale for the baccalaureate degree.
- A cumulative 2.5 on a 4.0 scale for the last 60 semester credits or 90 quarter credits (approximately two years of work) for the baccalaureate degree.
- An earned master's degree or higher from a regionally accredited institution or the recognized equivalent from an international institution supersedes the minimum GPA requirement for the baccalaureate.
- A cumulative GPA of 3.0 on a 4.0 scale for all graduate coursework completed for applicants who have not earned a master's degree or higher.

English Language Proficiency Test Score Requirements

The minimum TOEFL/IELTS/C1 Advanced/Duolingo English Test score requirements for this degree program are:

- Minimum TOEFL Score (Internet-based test): 80 with minimum of 20 on each sub-score
- Minimum IELTS Score: 6.5 with minimum of 6.0 on each band score
- Minimum C1 Advanced Score: 176
- Minimum Duolingo English Test Score: 115 with subscore minimums: Literacy, Comprehension-105; Conversation, Production-115. Tests prior to July 1, 2024: Literacy, Comprehension, Conversation-105; Production 95

Master's Degree Program

Master of Science in Information Technology with Concentration in AI Strategy and Application in IT

Minimum number of credits required: 48

Code	Title	Credits
Core coursework requirements		
ICT 4000	Business Essentials for Technology Leaders	4
ICT 4001	Technology Leadership	4
ICT 4005	Technical Essentials	4
ICT 4901	Capstone Project	4
or ICT 4902	Capstone Seminar	
Concentration requirements		
ICT 4700	AI Concepts, Capabilities, and Tools	4
ICT 4705	AI Ethics, Policy & Governance	4
ICT 4710	Strategic Application of AI in IT	4
ICT 4715	Developing AI Technical Solutions	4
Elective requirements (Choose four courses)		16
Total Credits		48

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Master of Science in Information Technology with Concentration in Cybersecurity Management

Minimum number of credits required: 48

Code	Title	Credits
Core course requirements		
ICT 4000	Business Essentials for Technology Leaders	4
ICT 4001	Technology Leadership	4
ICT 4005	Technical Essentials	4
ICT 4901	Capstone Project	4
or ICT 4902	Capstone Seminar	
Concentration requirements		
ICT 4205	Cybersecurity Management	4
ICT 4210	Cybersecurity Policy	4
ICT 4215	Cybersecurity Risk Management and Incident Response	4
ICT 4220	Cybersecurity Leadership and Strategic Planning	4
Elective requirements (choose 4 courses)		16
Total Credits		48

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Master of Science in Information Technology with Concentration in Database Design and Administration

Minimum number of credits required: 48

Code	Title	Credits
Core course requirements		
ICT 4000	Business Essentials for Technology Leaders	4
ICT 4001	Technology Leadership	4
ICT 4005	Technical Essentials	4
ICT 4901	Capstone Project	4
or ICT 4902	Capstone Seminar	

Concentration requirements		
ICT 4400	Database Administration	4
ICT 4405	Database Design and Implementation	4
ICT 4410	Data Warehousing Design	4
ICT 4415	Database Backup and Recovery with Lab	4
Elective requirements (Choose four courses)		16
Total Credits		48

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Master of Science in Information Technology with Concentration in Geographic Information Systems

Minimum number of credits required: 48

Code	Title	Credits
Core coursework requirements		
ICT 4000	Business Essentials for Technology Leaders	4
ICT 4001	Technology Leadership	4
ICT 4005	Technical Essentials	4
ICT 4901	Capstone Project	4
or ICT 4902	Capstone Seminar	
Concentration requirements		
GIS 4101	Introduction to Geographic Information Systems	4
GIS 4620	Geodatabase Application	4
GIS 4700	Remote Sensing I	4
GIS 4860	Web GIS	4
Elective requirements (Choose four courses)		16
Total Credits		48

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Master of Science in Information Technology with Concentration in Information Systems Security

Minimum number of credits required: 48

Code	Title	Credits
Core coursework requirements		
ICT 4000	Business Essentials for Technology Leaders	4
ICT 4001	Technology Leadership	4
ICT 4005	Technical Essentials	4
ICT 4901	Capstone Project	4
or ICT 4902	Capstone Seminar	
Concentration requirements		
ICT 4605	Principles of Information Security	4
ICT 4615	Identity and Access Management	4
ICT 4670	Disaster Recovery and Business Continuity Planning	4
ICT 4845	Information Systems Attacks and Defenses	4
Elective requirements (Choose four courses)		16
Total Credits		48

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Master of Science in Information Technology with Concentration in Project Management

Minimum number of credits required: 48

Code	Title	Credits
Core coursework requirements		
ICT 4000	Business Essentials for Technology Leaders	4
ICT 4001	Technology Leadership	4
ICT 4005	Technical Essentials	4
ICT 4901	Capstone Project	4
or ICT 4902	Capstone Seminar	
Concentration requirements		
ICT 4100	Principles of Project Management	4
ICT 4105	Project Contracts and Procurement	4
ICT 4110	Project Risk and Quality Management	4
ICT 4170	Agile Techniques and Practices in Project Management	4
Elective requirements (Choose four courses)		16
Total Credits		48

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Master of Science in Information Technology with Concentration in Software Design and Programming

Minimum number of credits required: 48

Code	Title	Credits
Core coursework requirements		
ICT 4000	Business Essentials for Technology Leaders	4
ICT 4001	Technology Leadership	4
ICT 4005	Technical Essentials	4
ICT 4901	Capstone Project	4
or ICT 4902	Capstone Seminar	
Concentration requirements		
ICT 4300	Web Enabled Information Systems	4
ICT 4305	Object-Oriented Methods and Programming I	4
ICT 4310	Distributed Computing	4
ICT 4315	Object-Oriented Methods and Programming II	4
Elective requirements (Choose four courses)		16
Total Credits		48

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Master of Science in Information Technology with Concentration in Technology Management

Minimum number of credits required: 48

Code	Title	Credits
Core coursework requirements		
ICT 4000	Business Essentials for Technology Leaders	4
ICT 4001	Technology Leadership	4
ICT 4005	Technical Essentials	4
ICT 4901	Capstone Project	4
or ICT 4902	Capstone Seminar	
Concentration requirements		

ICT 4015	Managing Technology for Strategic Value	4
ICT 4025	Managing the Innovation Process	4
ICT 4100	Principles of Project Management	4
UNIV 4520	Finance for Organizational Success	4
Elective requirements (Choose four courses)		16
Total Credits		48

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Master of Science in Information Technology with Concentration in Web Design and Development

Minimum number of credits required: 48

Code	Title	Credits
Core coursework requirements		
ICT 4000	Business Essentials for Technology Leaders	4
ICT 4001	Technology Leadership	4
ICT 4005	Technical Essentials	4
ICT 4901	Capstone Project	4
or ICT 4902	Capstone Seminar	
Concentration requirements		
ICT 4300	Web Enabled Information Systems	4
ICT 4505	Website Design and Management	4
ICT 4510	Advanced Website Design and Management	4
ICT 4515	Usability Design for Websites	4
Elective requirements (Choose four courses)		16
Total Credits		48

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Graduate Certificate Programs

Graduate Certificate in Information Technology with Concentration in AI Strategy and Application in IT

Minimum number of credits required: 24

Code	Title	Credits
Concentration requirements		
ICT 4700	AI Concepts, Capabilities, and Tools	4
ICT 4705	AI Ethics, Policy & Governance	4
ICT 4710	Strategic Application of AI in IT	4
ICT 4715	Developing AI Technical Solutions	4
Elective requirements (Choose two courses)		8
Total Credits		24

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Graduate Certificate in Information Technology with Concentration in Cybersecurity Management

Minimum number of credits required: 24

Code	Title	Credits
Concentration requirements		
ICT 4205	Cybersecurity Management	4
ICT 4210	Cybersecurity Policy	4

ICT 4215	Cybersecurity Risk Management and Incident Response	4
ICT 4220	Cybersecurity Leadership and Strategic Planning	4
Elective requirements (Choose two courses)		8
Total Credits		24

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Graduate Certificate in Information Technology with Concentration in Database Design and Administration

Minimum number of credits required: 24

Code	Title	Credits
Concentration requirements		
ICT 4400	Database Administration	4
ICT 4405	Database Design and Implementation	4
ICT 4410	Data Warehousing Design	4
ICT 4415	Database Backup and Recovery with Lab	4
Elective requirements (Choose two courses)		8
Total Credits		24

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Graduate Certificate in Information Technology with Concentration in Information Systems Security

Minimum number of credits required: 24

Code	Title	Credits
Concentration requirements		
ICT 4605	Principles of Information Security	4
ICT 4615	Identity and Access Management	4
ICT 4670	Disaster Recovery and Business Continuity Planning	4
ICT 4845	Information Systems Attacks and Defenses	4
Elective requirements (Choose two courses)		8
Total Credits		24

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Graduate Certificate in Information Technology with Concentration in Project Management

Minimum number of credits required: 24

Code	Title	Credits
Concentration requirements		
ICT 4100	Principles of Project Management	4
ICT 4105	Project Contracts and Procurement	4
ICT 4110	Project Risk and Quality Management	4
ICT 4170	Agile Techniques and Practices in Project Management	4
Elective requirements (Choose two courses)		8
Total Credits		24

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Graduate Certificate in Information Technology with Concentration in Software Design and Programming

Minimum number of credits required: 24

Code	Title	Credits
Concentration requirements		
ICT 4300	Web Enabled Information Systems	4
ICT 4305	Object-Oriented Methods and Programming I	4
ICT 4310	Distributed Computing	4
ICT 4315	Object-Oriented Methods and Programming II	4
Elective requirements (Choose two courses)		8
Total Credits		24

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Graduate Certificate in Information Technology with Concentration in Technology Management

Minimum number of credits required: 24

Code	Title	Credits
Concentration requirements		
ICT 4015	Managing Technology for Strategic Value	4
ICT 4025	Managing the Innovation Process	4
ICT 4100	Principles of Project Management	4
UNIV 4520	Finance for Organizational Success	4
Elective requirements (Choose two courses)		8
Total Credits		24

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Graduate Certificate in Information Technology with Concentration in Web Design and Development

Minimum number of credits required: 24

Code	Title	Credits
Concentration requirements		
ICT 4300	Web Enabled Information Systems	4
ICT 4505	Website Design and Management	4
ICT 4510	Advanced Website Design and Management	4
ICT 4515	Usability Design for Websites	4
Elective requirements (Choose two courses)		8
Total Credits		24

Students will work with their academic advisor to determine the best set of courses to choose for their electives.

Specialized Graduate Certificate Programs

Specialized Graduate Certificate in AI Strategy and Application in IT

Code	Title	Credits
Required courses		
ICT 4700	AI Concepts, Capabilities, and Tools	4
ICT 4705	AI Ethics, Policy, & Governance	4
ICT 4710	Strategic Application of AI in IT	4

ICT 4715	Developing AI Technical Solutions	4
Total Credits		16

Specialized Graduate Certificate in Cybersecurity Management

Code	Title	Credits
ICT 4205	Cybersecurity Management	4
ICT 4210	Cybersecurity Policy	4
ICT 4215	Cybersecurity Risk Management and Incident Response	4
ICT 4220	Cybersecurity Leadership and Strategic Planning	4
Total Credits		16

Specialized Graduate Certificate in Database Design and Administration

Code	Title	Credits
ICT 4400	Database Administration	4
ICT 4405	Database Design and Implementation	4
ICT 4410	Data Warehousing Design	4
ICT 4415	Database Backup and Recovery with Lab	4
Total Credits		16

Specialized Graduate Certificate in Information Systems Security

Code	Title	Credits
ICT 4605	Principles of Information Security	4
ICT 4615	Identity and Access Management	4
ICT 4670	Disaster Recovery and Business Continuity Planning	4
ICT 4845	Information Systems Attacks and Defenses	4
Total Credits		16

Specialized Graduate Certificate in Project Management

Code	Title	Credits
ICT 4100	Principles of Project Management	4
ICT 4105	Project Contracts and Procurement	4
ICT 4110	Project Risk and Quality Management	4
ICT 4170	Agile Techniques and Practices in Project Management	4
Total Credits		16

Specialized Graduate Certificate in Software Design and Programming

Code	Title	Credits
ICT 4300	Web Enabled Information Systems	4
ICT 4305	Object-Oriented Methods and Programming I	4
ICT 4310	Distributed Computing	4
ICT 4315	Object-Oriented Methods and Programming II	4
Total Credits		16

Specialized Graduate Certificate in Technology Management

Code	Title	Credits
ICT 4015	Managing Technology for Strategic Value	4
ICT 4025	Managing the Innovation Process	4
ICT 4100	Principles of Project Management	4
UNIV 4520	Finance for Organizational Success	4
Total Credits		16

Specialized Graduate Certificate in Web Design and Development

Code	Title	Credits
ICT 4300	Web Enabled Information Systems	4
ICT 4505	Website Design and Management	4
ICT 4510	Advanced Website Design and Management	4
ICT 4515	Usability Design for Websites	4
Total Credits		16

ICT 4000 Business Essentials for Technology Leaders (4 Credits)

In this course, students will explore the essential attributes of business research and analysis in the Information Technology (IT) field to make appropriate business decisions. Students will individually and in teams explore the economic principles that drive the IT industry. This course sets the foundation for research, analysis, and critical thinking that will be encountered and required throughout the program. As such, a major component of this course is writing research papers on various topics including economic and technical drivers and challenges, IT economic principles, and the regulatory 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 IT 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 Technical Essentials (4 Credits)

In this course, students will examine the essential technologies that comprise the field of Information Technology (IT). Students will explore each technical discipline as groundwork for pursuing a specialized discipline while also gaining an understanding of how the disciplines work together. A major component of this course is conducting research and writing analyses of the various technical topics that drive the IT industry. This course sets the foundation for technical research, analysis, and critical thinking that will be encountered and required throughout the IT program.

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 IT related topics such as cloud computing, global regulatory compliance, data protection, artificial intelligence, and IT 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 Managing the Innovation Process (4 Credits)

Students will experience innovation management by developing a new product from ideation to adoption. Students will craft compelling product visions, create innovative cultures, and align teams to their innovation strategy. They will develop a product roadmap and a team that can not only deliver the product, but support its ongoing operations in the market. Students will practice setting strategic objectives for the new product, and explore regulatory, licensing, and pricing concepts — and then bring that information together in a product forecast that helps an enterprise understand product performance from awareness to adoption. All of these elements come together as the project's new product introduction plan, delivered in the final presentation. Required Prerequisite: 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 Essentials (4 Credits)

This course will provide students with an understanding of cybersecurity and the importance of implementing sound cybersecurity policies, procedures, and systems as the basis for overall enterprise security. All areas (domains) of information security and cybersecurity are covered in depth for a comprehensive understanding of what's required for the overall protection of assets. This course is for students who are new to cybersecurity 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 delves into the multifaceted realm of cybersecurity management. Students step into the roles of cybersecurity managers, exploring essential components such as the RACI matrix, project charters, and controls assessment plans. By embracing a comprehensive organizational perspective, students acquire the strategic skills needed to navigate the cybersecurity landscape and enhance security for the future. The curriculum emphasizes risk control within defined contexts, leveraging compliance frameworks and industry best practices. Students explore cybersecurity management, from setting objectives and goals to implementing security controls and best practices. Ultimately, students gain insights into management responsibilities, including policy oversight, legal compliance, and report creation for cybersecurity managers, such as reports for a Board of Directors. Recommended Prerequisite: 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 leadership roles and responsibilities, including the skills required for supervising and managing employees performing cybersecurity-related work. The course will provide students with an understanding of the tools and techniques required for analyzing technology, management, and leadership issues related to organizational processes and problem-solving. Students will learn how to develop new policies and advocate for changes to existing policies that align with organizational goals and cyberspace initiatives, including compliance with various laws and regulatory requirements. The course will also cover cybersecurity risk management concepts and practices. Recommended prerequisite: ICT 4200 or practical experience in information systems security principles and practices.

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 front-end to the database back-end 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 Design and Development.

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

This is the first of two courses introducing object-oriented methodologies and programming concepts using the Java programming language. Students will apply Agile tools and techniques, along with Unified Modeling Language (UML), in the software development process. The course explores object-oriented concepts such as abstraction, encapsulation, generalization, and polymorphism. Students will practice these concepts through hands-on programming and define testing procedures. Additionally, they will use integrated development tools and assess the role of software design frameworks. Students without 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 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 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 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 equips students with comprehensive Python programming skills, ranging from beginner to advanced level, along with hands-on modern application development. Students will practice core concepts such as object-oriented programming, unit testing, System I/O, multithreading, API development, databases, data analysis and visualization, and building AI agents using powerful LLMs. The course emphasizes a fast-paced, practical approach to immerse students in software design and implementation, system integration, and AI-powered solutions, equipping students with the knowledge and skills that are in demand in today's job market. Recommended prerequisite: ICT 4007 (if a student has no prior programming experience).

ICT 4375 Blockchain, Cryptocurrency, and Web3 (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 apply decentralized technologies like blockchains, cryptocurrencies, tokens, 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 financial perspective. Knowledge of basic programming principles is recommended.

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 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.

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 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. In this course, students learn about information security risk management, asset security, security architecture and engineering, communication and network security, identity and access management, security assessment and testing, security operations, and software development security. The course applies a systems approach to security issues to analyze and develop security solutions. The information covered includes contemporary issues of cybercrime and how to mitigate cybersecurity risks. 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 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 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, training needs, and practices that are used to secure the modern software development lifecycle (SDLC). Topics include enhancing Agile/Scrum development processes with secure design models and application risk analysis, application lifecycle management, defensive programming, secure DevOps, and AppSec (application security) issues with new technology and new consumer devices. Recommended prerequisite: ICT 4605.

ICT 4700 AI Concepts, Capabilities, and Tools (4 Credits)

This graduate-level course provides a comprehensive exploration of evolving artificial intelligence (AI) concepts, tools, and their applications in organizational settings. The course is tailored for all learners seeking to gain a foundational understanding of AI concepts. Students will gain a deep understanding of the benefits, limitations, and tradeoffs associated with designing and engaging with AI tools. The course aims to empower students to champion appropriate AI use within organizations, identify business or organizational problems suitable for AI solutions, and navigate the dynamic landscape of AI in their respective industries.

ICT 4701 Topics in Information 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 Technology degree and certificate programs, and, with advance approval from Academic Director, may substitute for core courses in the degree or certificate program.

ICT 4705 AI Ethics, Policy & Governance (4 Credits)

This course delves into the critical aspects of AI governance, ethics, and policy. It equips students with the skills to analyze AI frameworks, develop ethical guidelines, and craft policies that drive responsible AI innovation and deployment. Students will learn to communicate complex AI issues effectively, adapting their strategies to diverse audiences and stakeholders. The course emphasizes the importance of identifying and mitigating AI risks, including biases and privacy concerns, by employing industry best practices in system design and implementation. Through a blend of theoretical knowledge and practical application, students will explore how to align AI tools with organizational goals, ensuring that AI solutions not only advance technical systems but also adhere to ethical standards. Students will become informed leaders capable of shaping the AI landscape, ready to integrate ethical AI governance into their professional environments for a sustainable and ethical future in technology. Required Prerequisite: ICT 4700.

ICT 4710 Strategic Application of AI in IT (4 Credits)

Students will gain the practical skills to harness the power of AI and drive organizational success. By analyzing cutting-edge AI tools and strategies, students will learn how to achieve specific organizational goals such as automating tasks, improving decision-making, and enhancing customer experiences. Building on a student's foundational knowledge of AI technologies, students will delve into real-world applications of AI, exploring how to drive innovation, optimize processes, mitigate risks, and create a competitive edge. By the end of the course, students will be equipped to lead AI initiatives with the strategic thinking skills and practical knowledge necessary to effectively integrate AI into their IT organization and deliver tangible business value. Required Prerequisite: ICT 4700.

ICT 4715 Developing AI Technical Solutions (4 Credits)

This course guides students through the end-to-end process of developing AI solutions using a no-code to low-code approach. Students will learn how to identify business problems suitable for AI, prepare data for model training, design solution workflows, and plan model deployment and integration. The course emphasizes ethical considerations and best practices for monitoring and maintaining AI systems. Through weekly assignments that build toward a comprehensive capstone project, students will gain practical experience in designing, deploying, and presenting AI solutions ready for real-world implementation. Students will gain practical skills using AWS and wireframing tools. This course equips students with the essential skills to develop and deploy AI solutions to achieve organizational goals. Prerequisite: ICT 4700.

ICT 4845 Information Systems Attacks and Defenses (4 Credits)

This course will provide students with the knowledge and skills necessary to conduct effective penetration testing and develop defensive techniques that prevent the attack(s) or reduce the effectiveness or impact of those attacks, should they succeed. Students will focus on real-world examples of both perimeter network security and desktop security across almost any computing environment. Students can work with a range of network security toolboxes in a hands-on, robust software lab environment. Students will also learn how to use the MITRE ATT&CK framework to identify and analyze various attack techniques, tactics, and procedures (TTPs) used by adversaries and will understand how to apply Cyber Kill-chain strategies, followed by using the MITRE D3FEND framework to implement effective defensive measures to mitigate and prevent these and future attacks. Recommended Prerequisite: 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 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 IT 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 IT 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 IT 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 IT 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.

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

In this course, students will explore the essential attributes of business research and analysis in the Information Technology (IT) field to make appropriate business decisions. Students will individually and in teams explore the economic principles that drive the IT industry. This course sets the foundation for research, analysis, and critical thinking that will be encountered and required throughout the program. As such, a major component of this course is writing research papers on various topics including economic and technical drivers and challenges, IT economic principles, and the regulatory 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 IT 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 Technical Essentials (4 Credits)

In this course, students will examine the essential technologies that comprise the field of Information Technology (IT). Students will explore each technical discipline as groundwork for pursuing a specialized discipline while also gaining an understanding of how the disciplines work together. A major component of this course is conducting research and writing analyses of the various technical topics that drive the IT industry. This course sets the foundation for technical research, analysis, and critical thinking that will be encountered and required throughout the IT program.

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 IT related topics such as cloud computing, global regulatory compliance, data protection, artificial intelligence, and IT 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 Managing the Innovation Process (4 Credits)

Students will experience innovation management by developing a new product from ideation to adoption. Students will craft compelling product visions, create innovative cultures, and align teams to their innovation strategy. They will develop a product roadmap and a team that can not only deliver the product, but support its ongoing operations in the market. Students will practice setting strategic objectives for the new product, and explore regulatory, licensing, and pricing concepts — and then bring that information together in a product forecast that helps an enterprise understand product performance from awareness to adoption. All of these elements come together as the project's new product introduction plan, delivered in the final presentation. Required Prerequisite: 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 Essentials (4 Credits)

This course will provide students with an understanding of cybersecurity and the importance of implementing sound cybersecurity policies, procedures, and systems as the basis for overall enterprise security. All areas (domains) of information security and cybersecurity are covered in depth for a comprehensive understanding of what's required for the overall protection of assets. This course is for students who are new to cybersecurity 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 delves into the multifaceted realm of cybersecurity management. Students step into the roles of cybersecurity managers, exploring essential components such as the RACI matrix, project charters, and controls assessment plans. By embracing a comprehensive organizational perspective, students acquire the strategic skills needed to navigate the cybersecurity landscape and enhance security for the future. The curriculum emphasizes risk control within defined contexts, leveraging compliance frameworks and industry best practices. Students explore cybersecurity management, from setting objectives and goals to implementing security controls and best practices. Ultimately, students gain insights into management responsibilities, including policy oversight, legal compliance, and report creation for cybersecurity managers, such as reports for a Board of Directors. Recommended Prerequisite: 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 leadership roles and responsibilities, including the skills required for supervising and managing employees performing cybersecurity-related work. The course will provide students with an understanding of the tools and techniques required for analyzing technology, management, and leadership issues related to organizational processes and problem-solving. Students will learn how to develop new policies and advocate for changes to existing policies that align with organizational goals and cyberspace initiatives, including compliance with various laws and regulatory requirements. The course will also cover cybersecurity risk management concepts and practices. Recommended prerequisite: ICT 4200 or practical experience in information systems security principles and practices.

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 front-end to the database back-end 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 Design and Development.

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

This is the first of two courses introducing object-oriented methodologies and programming concepts using the Java programming language. Students will apply Agile tools and techniques, along with Unified Modeling Language (UML), in the software development process. The course explores object-oriented concepts such as abstraction, encapsulation, generalization, and polymorphism. Students will practice these concepts through hands-on programming and define testing procedures. Additionally, they will use integrated development tools and assess the role of software design frameworks. Students without 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 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 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 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 equips students with comprehensive Python programming skills, ranging from beginner to advanced level, along with hands-on modern application development. Students will practice core concepts such as object-oriented programming, unit testing, System I/O, multithreading, API development, databases, data analysis and visualization, and building AI agents using powerful LLMs. The course emphasizes a fast-paced, practical approach to immerse students in software design and implementation, system integration, and AI-powered solutions, equipping students with the knowledge and skills that are in demand in today's job market. Recommended prerequisite: ICT 4007 (if a student has no prior programming experience).

ICT 4375 Blockchain, Cryptocurrency, and Web3 (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 apply decentralized technologies like blockchains, cryptocurrencies, tokens, 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 financial perspective. Knowledge of basic programming principles is recommended.

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 an 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 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.

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 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. In this course, students learn about information security risk management, asset security, security architecture and engineering, communication and network security, identity and access management, security assessment and testing, security operations, and software development security. The course applies a systems approach to security issues to analyze and develop security solutions. The information covered includes contemporary issues of cybercrime and how to mitigate cybersecurity risks. 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 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 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, training needs, and practices that are used to secure the modern software development lifecycle (SDLC). Topics include enhancing Agile/Scrum development processes with secure design models and application risk analysis, application lifecycle management, defensive programming, secure DevOps, and AppSec (application security) issues with new technology and new consumer devices. Recommended prerequisite: ICT 4605.

ICT 4700 AI Concepts, Capabilities, and Tools (4 Credits)

This graduate-level course provides a comprehensive exploration of evolving artificial intelligence (AI) concepts, tools, and their applications in organizational settings. The course is tailored for all learners seeking to gain a foundational understanding of AI concepts. Students will gain a deep understanding of the benefits, limitations, and tradeoffs associated with designing and engaging with AI tools. The course aims to empower students to champion appropriate AI use within organizations, identify business or organizational problems suitable for AI solutions, and navigate the dynamic landscape of AI in their respective industries.

ICT 4701 Topics in Information 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 Technology degree and certificate programs, and, with advance approval from Academic Director, may substitute for core courses in the degree or certificate program.

ICT 4705 AI Ethics, Policy & Governance (4 Credits)

This course delves into the critical aspects of AI governance, ethics, and policy. It equips students with the skills to analyze AI frameworks, develop ethical guidelines, and craft policies that drive responsible AI innovation and deployment. Students will learn to communicate complex AI issues effectively, adapting their strategies to diverse audiences and stakeholders. The course emphasizes the importance of identifying and mitigating AI risks, including biases and privacy concerns, by employing industry best practices in system design and implementation. Through a blend of theoretical knowledge and practical application, students will explore how to align AI tools with organizational goals, ensuring that AI solutions not only advance technical systems but also adhere to ethical standards. Students will become informed leaders capable of shaping the AI landscape, ready to integrate ethical AI governance into their professional environments for a sustainable and ethical future in technology. Required Prerequisite: ICT 4700.

ICT 4710 Strategic Application of AI in IT (4 Credits)

Students will gain the practical skills to harness the power of AI and drive organizational success. By analyzing cutting-edge AI tools and strategies, students will learn how to achieve specific organizational goals such as automating tasks, improving decision-making, and enhancing customer experiences. Building on a student's foundational knowledge of AI technologies, students will delve into real-world applications of AI, exploring how to drive innovation, optimize processes, mitigate risks, and create a competitive edge. By the end of the course, students will be equipped to lead AI initiatives with the strategic thinking skills and practical knowledge necessary to effectively integrate AI into their IT organization and deliver tangible business value. Required Prerequisite: ICT 4700.

ICT 4715 Developing AI Technical Solutions (4 Credits)

This course guides students through the end-to-end process of developing AI solutions using a no-code to low-code approach. Students will learn how to identify business problems suitable for AI, prepare data for model training, design solution workflows, and plan model deployment and integration. The course emphasizes ethical considerations and best practices for monitoring and maintaining AI systems. Through weekly assignments that build toward a comprehensive capstone project, students will gain practical experience in designing, deploying, and presenting AI solutions ready for real-world implementation. Students will gain practical skills using AWS and wireframing tools. This course equips students with the essential skills to develop and deploy AI solutions to achieve organizational goals. Prerequisite: ICT 4700.

ICT 4845 Information Systems Attacks and Defenses (4 Credits)

This course will provide students with the knowledge and skills necessary to conduct effective penetration testing and develop defensive techniques that prevent the attack(s) or reduce the effectiveness or impact of those attacks, should they succeed. Students will focus on real-world examples of both perimeter network security and desktop security across almost any computing environment. Students can work with a range of network security toolboxes in a hands-on, robust software lab environment. Students will also learn how to use the MITRE ATT&CK framework to identify and analyze various attack techniques, tactics, and procedures (TTPs) used by adversaries and will understand how to apply Cyber Kill-chain strategies, followed by using the MITRE D3FEND framework to implement effective defensive measures to mitigate and prevent these and future attacks. Recommended Prerequisite: 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 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 IT 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 IT 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 IT 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 IT 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.