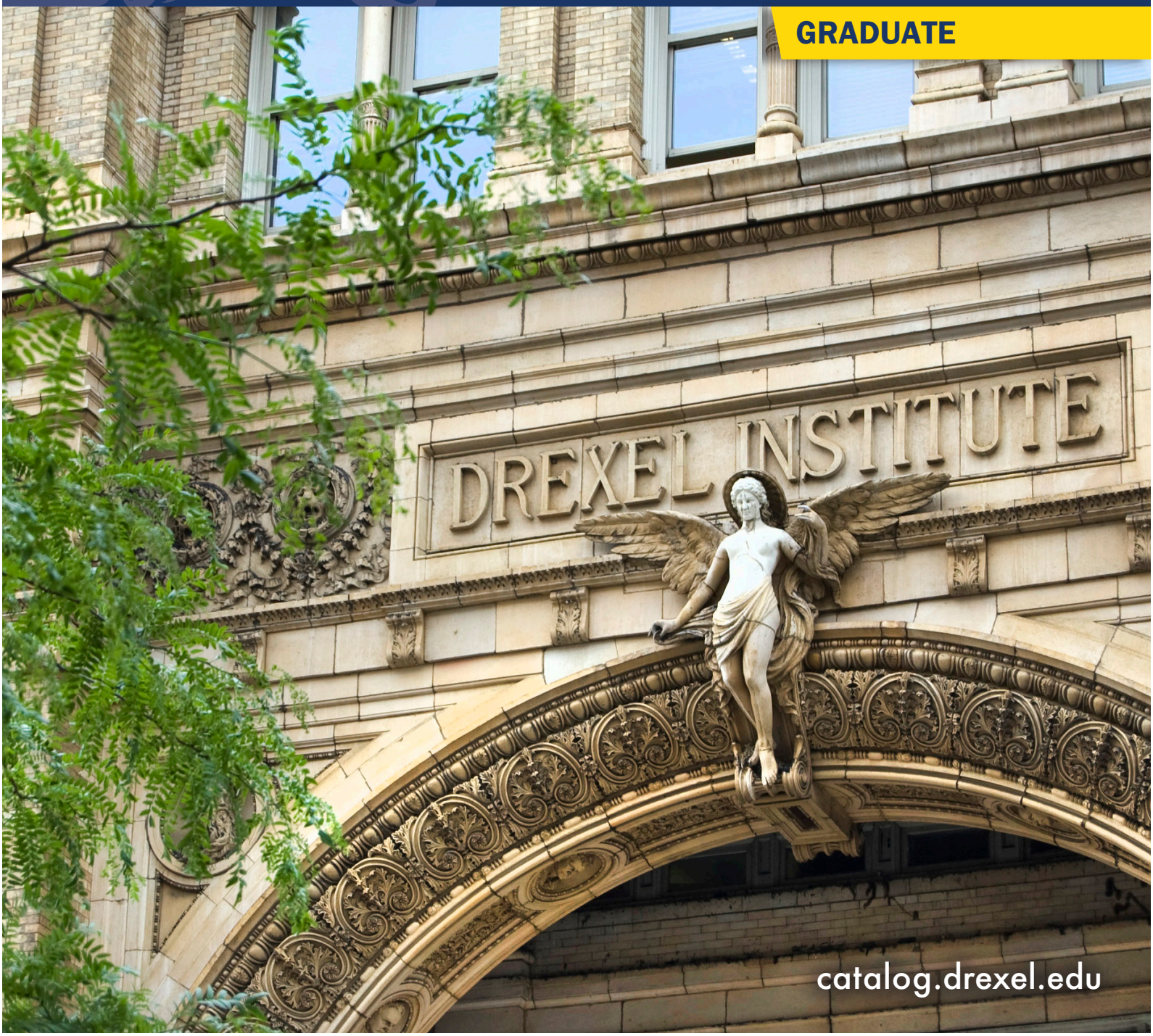
DREXEL UNIVERSITY
College of
Computing & Informatics

CATALOG
2022-2023

GRADUATE



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College of Computing & Informatics

From our position on the leading edge of information and technology, Drexel University's College of Computing & Informatics (CCI) instills the knowledge and skills necessary for our students to lead and innovate across industries in a rapidly evolving technological landscape.

Building on Drexel University's exceptional foundation of entrepreneurship and cooperative education, we provide unparalleled professional experiences and on-the-job training that is vital to preparing today's students for tomorrow's world. At CCI, our unique structure bringing computing and informatics together under one roof in a dynamic, collaborative college allows us to spot trends before they emerge, to solve problems before they occur, and to build a better tomorrow starting today.

The College contributes to theory and practice along dimensions that include technical, human, organizational, policy, and societal considerations. This broad perspective positions the College to address the complex, multi-disciplinary problems that are increasingly common as society becomes more dependent on information technology.

The College's academic programs provide broad and deep coverage of computing and informatics. For more information about the College, please visit the College's website (https://drexel.edu/cci/).

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College of Computing & Informatics Faculty

Denise E. Agosto, PhD *(Rutgers, The State University of New Jersey)*. Professor. Youth information behaviors, public libraries, multicultural issues in youth library services, and qualitative research methods.

Adelaida Alban Medlock, MS *(Drexel University) Associate Department Head for Undergraduate Affairs, Computer Science*. Teaching Professor. Introductory programming, computer science education

Yuan An, PhD *(University of Toronto, Canada) Director of International Programs*. Associate Professor. Conceptual modeling, schema and ontology mapping, information integration, knowledge representation, requirements engineering, healthcare information systems, semantic web.

David Augenblick, MS *(University of Pennsylvania)*. Associate Teaching Professor. Introductory and object-oriented programming, data structures and database systems, computer application project management, application of computer programming principles and solutions to engineering problems.

Ellen Bass, PhD *(Georgia Institute of Technology) Joint Appointment with the College of Nursing and Health Professions*. Professor. Characterizing human judgement and decision making, modeling human judgement when supported by information automation, computational models of human-human and human-automation coordination.

Mark Boady, PhD *(Drexel University)*. Assistant Teaching Professor. Computer Algebra, complex symbolic calculations, automation of computation problems

David E. Breen, PhD *(Rensselaer Polytechnic Institute) Associate Department Head for Graduate Affairs, Computer Science*. Professor. Computer-aided design, biomedical image informatics, geometric modeling and self-organization algorithms.

Matthew Burlick, PhD *(Stevens Institute of Technology)*. Associate Teaching Professor. Image processing, machine learning, real-time video tracking, object detection and classification, statistics/probability, and acoustics

Yuanfang Cai, PhD *(University of Virginia)*. Professor. Formal software design modeling and analysis, software economics, software evolution and modularity.

Christopher Carroll, MS *(Drexel University) BSCST Program Director*. Associate Teaching Professor. Information technology within healthcare companies, computer networking and design, IT infrastructure, server technology, information security, virtualization and cloud computing.

Preetha Chatterjee, PhD *(University of Delaware)*. Assistant Professor. Software engineering, data mining, natural language processing, and machine learning.

Chaomei Chen, PhD *(University of Liverpool)*. Professor. Information visualization, visual analytics, knowledge domain visualization, network analysis and modeling, scientific discovery, science mapping, scientometrics, citation analysis, human-computer interaction.

Michael Chu, MSE *(University of Pennsylvania)*. Associate Teaching Professor. System, server, computer networking and design; IT infrastructure; information technology management and security; Web system programming; database and mobile application development.

Andrea Forte, PhD *(Georgia Institute of Technology) PhD Program Director, and MS in Information Program Director*. Associate Professor. Social computing, human-computer interaction, computer-supported cooperative work, computer-supported collaborative learning, information literacy.

Susan Gasson, PhD *(University of Warwick)*. Associate Professor. The co-design of business and IT-systems, distributed cognition & knowledge management in boundary-spanning groups, human-centered design, social informatics, online learning communities, grounded theory.

Vasilis Gkatzelis, PhD *(New York University)*. Assistant Professor. Algorithmic mechanism design, multiagent resource allocation, approximation, algorithms.

Colin Gordon, PhD *(University of Washington)*. Associate Professor. Software reliability, program behavior, concurrent and systems-level code, formal assurance, programming models, distributed computing, even testing

Tim Gorichanaz, PhD *(Drexel University)*. Assistant Teaching Professor. Human information behavior, human-centered computing, neo-documentation studies, and information ethics.

Jane Greenberg, PhD *(University of Pittsburgh) Alice B. Kroeger Professor*. Metadata, ontological engineering, data science, knowledge organization, information retrieval

Peter Grillo, PhD *(Temple University) Associate Department Head for Undergraduate Affairs, Information Science*. Teaching Professor. Software economics, Project management, Strategic applications of technology within organizations.

Thomas Heverin, PhD *(Drexel University)*. Associate Teaching Professor. Computer security, ethical hacking, computer forensics, network forensics, cloud security and cybersecurity.

Gregory W. Hislop, PhD *(Drexel University)*. Professor. Information technology for teaching and learning, online education, structure and organization of the information disciplines, computing education research, software evaluation and characterization.

Xiaohua Tony Hu, PhD *(University of Regina, Canada)*. Professor. Data mining, text mining, Web searching and mining, information retrieval, bioinformatics, and healthcare informatics.

Jina Huh-Yoo, PhD *(University of Michigan at Ann Arbor)*. Assistant Professor. Human-computer interaction, human-centered design, Health informatics, mobile and wireless health, social computing.

Shahin Jabbari, PhD *(University of Pennsylvania)*. Assistant Professor. Algorithmic fairness, game theory, and artificial intelligence for social good.

Constantine Katsinis, PhD *(University of Rhode Island)*. Teaching Professor. High-performance computer networks, parallel computer architectures with sustained teraflops performance, computer security, image processing.

Weimao Ke, PhD *(University of North Carolina at Chapel Hill)*. Associate Professor. Information retrieval (IR), distributed systems, intelligent filtering/recommendation, information visualization, network science, complex systems, machine learning, text/data mining, multi-agent systems, the notion of information.

Mat Kelly, PhD *(Old Dominion University)*. Assistant Professor. Information retrieval, Web archives, metadata, digital humanities, archival privacy

Ehsan B. Khosroshahi, PhD *(Drexel University)*. Assistant Teaching Professor. Computational cognitive modeling, artificial intelligence, machine learning and data analysis.

Edward Kim, PhD *(Lehigh University)*. Associate Professor. Computer Vision, Sparse Coding, Neuromorphic Computing, Medical Image Processing, Computer Graphics, Artificial Intelligence, Game Development

Xia Lin, PhD *(University of Maryland at College Park) Department Head, Information Science*. Professor. Digital libraries, information visualization, visual interface design, knowledge mapping, human-computer interaction, information retrieval, information architecture, informetrics, information-seeking behaviors in digital environments.

Galen Long, MS *(Drexel University)*. Assistant Teaching Professor. Computer Science.

Chris MacLellan, PhD *(Carnegie Mellon University)*. Assistant Professor. Artificial intelligence, data science, machine learning, human-computer interaction, cognitive modeling.

Geoffrey Mainland, PhD *(Harvard University)*. Associate Professor. High-level programming languages and runtime support for non-general-purpose computation.

Spiros Mancoridis, PhD *(University of Toronto) The Auerbach Berger Chair in Cybersecurity Distinguished Professor of Computer Science*. Professor. Software engineering; software security; code analysis; evolutionary computation.

Danuta A. Nitecki, PhD *(University of Maryland at College Park) Dean of Libraries*. Professor. Library metrics and use in management, library as place, and academic library service models.

Krzysztof Nowak, PhD *(Washington University)*. Associate Teaching Professor. Fourier analysis, partial differential equations, image processing, wavelets, asymptotic distribution of eigenvalues, numerical methods and algorithms, computer science education.

Santiago Ontañón, PhD *(University of Barcelona)*. Associate Professor. Game AI, computer games, artificial intelligence, machine learning, case-based reasoning

Yusuf Osmanlioglu, PhD *(Drexel University)*. Assistant Teaching Professor. Graph theory and algorithms, brain network analysis, optimization, computer vision, natural language processing.

Jung-ran Park, PhD *(University of Hawaii at Manoa)*. Associate Professor. Knowledge organization and representation, metadata, computer-mediated communication, cross-cultural communication, multilingual information access.

Chad Peiper, PhD *(University of Ilinois)*. Associate Teaching Professor. Cloud computing, blockchain, self-sovereign identity (SSI), data privacy, decentralization.

Tammy Pirmann, Ed D *(Gwynedd Mercy University)*. Teaching Professor. Introductory programming, object-oriented programming, game design, mobile computing, computer science education, computer science educator pipeline

Alex Poole, PhD *(University of North Carolina)*. Assistant Professor. Digital curation, archives and records management, digital humanities, and diversity, inclusivity, and equity.

Jeffrey L. Popyack, PhD *(University of Virginia)*. Professor. Operations research, stochastic optimization, computational methods of Markov decision processes; artificial intelligence, computer science education.

Emmanouil Pountourakis, PhD *(Northwestern University)*. Assistant Professor. Algorithmic game theory, algorithmic mechanism design, algorithmic aspects of behavioral economics, game theory and learning, computational and game theoretic aspects of energy grids.

Shadi Reszpour, PhD *(University of Ilinois)*. Assistant Professor. Computational social science, natural language processing, network analysis, human-centered data science, computational linguistics.

Michelle L. Rogers, PhD *(University of Wisconsin-Madison)*. Associate Professor. Human-computer interaction, healthcare informatics, human factors engineering, socio-technical systems, health services research, patient safety.

Jeffrey Salvage, MS *(Drexel University)*. Teaching Professor. Object-oriented programming, multi-agent systems, software engineering, database theory, introductory programming, data structures.

Dario Salvucci, PhD *(Carnegie Mellon University)*. Professor. Human computer interaction, cognitive science, machine learning, applications for driving.

Aleksandra Sarcevic, PhD *(Rutgers University)*. Associate Professor. Computer-supported cooperative work, human-computer interaction, and healthcare informatics.

Kurt Schmidt, MS *(Drexel University)*. Associate Teaching Professor. Data structures, math foundations for computer science, programming tools, programming languages.

Bhupesh Shetty, PhD *(University of Iowa)*. Assistant Teaching Professor. Process pattern mining, data mining, operations management, sports analytics, information systems, and machine learning applications.

Ali Shokoufandeh, PhD *(Rutgers University) Senior Associate Dean for Academic Affairs and Operations*. Professor. Theory of algorithms, graph theory, combinational optimization, computer vision.

Il-Yeol Song, PhD *(Louisiana State University)*. Professor. Conceptual modeling, ontology and patterns, data warehouse and OLAP, object-oriented analysis and design with UML, medical and bioinformatics data modeling & integration.

Bo Song, PhD *(Drexel University)*. Assistant Teaching Professor. Database management, Data mining, bioinformatics, big data analytics, and knowledge discovery.

Brian Stuart, PhD *(Purdue University)*. Associate Teaching Professor. Machine learning, networking, robotics, image processing, simulation, interpreters, data storage, operating systems, computer science, data communications, distributed/operating systems, accelerated computer programming, computer graphics.

Michelle Tarbutton, MS *(Drexel University)*. Assistant Teaching Professor. Cybersecurity, computer forensics, memory forensics, cyberterrorism.

Hegler Tissot, PhD *(Universidade Federal do Parana)*. Assistant Teaching Professor. Knowledge representation, reasoning, machine learning, natural language processing, ontologies, pattern recognition, statistical analysis, and information extraction, health informatics.

Milad Toutounchian, PhD *(Simon Fraser University)*. Assistant Teaching Professor. Data Science, Applied Machine Learning and Deep Learning.

Boris Valerstein, MS *(Pennsylvania State University)*. Assistant Teaching Professor. Computer Science.

Dimitra Vista, PhD *(University of Toronto)*. Teaching Professor. Database systems.

Filippos Vokolos, PhD *(Polytechnic University)*. Associate Teaching Professor. System architecture, principles of software design and construction, verification and validation methods for the development of large software systems, foundations of software engineering, software verification & validation, software design, programming languages, dependable software systems.

Lei Wang, PhD *(Drexel University)*. Assistant Teaching Professor. Biomedical data science, machine learning, deep learning, neuroimaging processing & analytics, natural language processing, simulation modeling.

Rosina Weber, PhD *(Federal University of Santa Catarina)*. Associate Professor. Case-based reasoning, explainable artificial intelligence, machine learning, textual analytics, natural language understanding, language models, recommender systems, technological aspects of knowledge management, project management, and requirements engineering.

Jake Williams, PhD *(University of Vermont)*. Assistant Professor. Data science, scientific programming, computational social science,

computational linguistics and natural language processing, mathematics, machine learning, algorithms, and scalability.

Kaidi Xu, PhD *(Northeastern University)*. Assistant Professor. AI security, explainable artificial intelligence, optimization.

Erija Yan, PhD *(Indiana University Bloomington)*. Associate Professor. Network Science, information analysis and retrieval, scholarly communication methods and applications.

Christopher C. Yang, PhD *(University of Arizona, Tucson)*. Professor. Web search and mining, security informatics, knowledge management, social media analytics, cross-lingual information retrieval, text summarization, multimedia retrieval, information visualization, information sharing and privacy, artificial intelligence, digital library, and electronic commerce.

Emeritus Faculty

Michael E. Atwood, PhD *(University of Colorado)*. Professor Emeritus. Human-computer interaction, computer-supported cooperative work, organizational memory.

Bruce W. Char, PhD *(University of California-Berkeley)*. Professor Emeritus. Symbolic mathematical computation, algorithms and systems for computer algebra, problem-solving environments parallel and distributed computation.

Thomas A. Childers, PhD *(Rutgers University)*. Professor Emeritus. Measurement, evaluation, and planning of information and library services, the effectiveness of information organizations.

David E. Fenske, PhD *(University of Wisconsin-Madison)*. Dean Emeritus and Professor. Digital libraries, informatics, knowledge management and information technologies.

John B. Hall, PhD *(Florida State University)*. Professor Emeritus. Academic library service, library administration, organization of materials.

Katherine W. McCain, PhD *(Drexel University)*. Professor Emeritus. Scholarly communication, information production and use in the research process, development and structure of scientific specialties, diffusion of innovation, bibliometrics, evaluation of information retrieval systems.

Carol Hansen Montgomery, PhD *(Drexel University) Dean of Libraries Emeritus*. Research Professor. Selection and use of electronic collections, evaluation of library and information systems, digital libraries, economics of libraries and digital collections.

Delia Neuman, PhD *(The Ohio State University)*. Professor Emerita. Learning in information-rich environments, instructional systems design, the use of media for learning, and school library media.

Gerry Stahl, PhD *(University of Colorado)*. Professor Emeritus. Human-computer interaction, computer-supported cooperative work, computer-supported collaborative learning, theory of collaboration.

Howard D. White, PhD *(University of California at Berkeley)*. Professor Emeritus. Literature information systems, bibliometrics, research methods, collection development, online searching.

Susan Wiedenbeck, PhD *(University of Pittsburgh)*. Professor Emeritus. Human-computer interaction, end-user programming/end-user development, empirical studies of programmers, interface design and evaluation.

Artificial Intelligence and Machine Learning

Major: Artificial Intelligence and Machine Learning
Degree Awarded: Master of Science in Artificial Intelligence and Machine Learning
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: Available for full-time, on-campus master's-level students
Classification of Instructional Programs (CIP) code: 11.0701
Standard Occupational Classification (SOC) code: 15-0000

About the Program

The Master of Science in Artificial Intelligence and Machine Learning provides a strong foundation in the artificial intelligence and machine learning fields with foci on mathematical foundations, algorithms, tools, and applications as they pertain to artificial intelligence and machine learning. Students will pursue an applied or computational track and will gain competency in fundamental methods and techniques in artificial intelligence and machine learning. Their fundamental understanding will be applied to real data sets and data analysis tasks with the help of state-of-the-art technologies, tools, and platforms. The Master of Science in Artificial Intelligence and Machine Learning program culminates with a two-term capstone experience where students work on a real world or research problem using the knowledge they have gained throughout the program.

Admission Requirements

The Master of Science in Artificial Intelligence and Machine Learning accepts applicants who hold a four-year bachelor's degree or master’s degree from a regionally accredited institution in computer science, software engineering, or related STEM degree, plus work experience equal to Drexel's Post-Baccalaureate Certificate in Computer Science (p. 41). Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/artificial-intelligence-machine-learning/ms-in-artificial-intelligence-machine-learning/) for more information on admission requirements.

Additional Information

For more information about this program, visit the College of Computing & Informatics MS in Artificial Intelligence and Machine Learning webpage (https://drexel.edu/cci/academics/graduate-programs/artificial-intelligence-machine-learning/ms-in-artificial-intelligence-machine-learning/).

Degree Requirements

Core Courses		
CS 591	Artificial Intelligence and Machine Learning Capstone I	3.0
CS 592	Artificial Intelligence and Machine Learning Capstone II	3.0
Choose appropriate core courses for concentration:		9.0
Applied		
CS 501	Introduction to Programming	
or CS 570	Programming Foundations	
CS 614	Applications of Machine Learning	
INFO 629	Applied Artificial Intelligence	
Computational		
CS 510	Introduction to Artificial Intelligence	
CS 613	Machine Learning	
CS 615	Deep Learning	
Breadth Requirements		**9.0**
One course must be selected from each group for the appropriate concentration		
Applied		
Data Science Foundations		
DSCI 501	Quantitative Foundations of Data Science	
DSCI 511	Data Acquisition and Pre-Processing	
DSCI 521	Data Analysis and Interpretation	
DSCI 631	Applied Machine Learning for Data Science	
DSCI 632	Applied Cloud Computing	
INFO 546	Data Analytics for Community-Based Data and Service	
INFO 623	Social Network Analytics	
INFO 634	Data Mining	
INFO 659	Introduction to Data Analytics	
AI Foundations		
CS 502	Data Structures and Algorithms	
CS 503	Systems Basics	
CS 510	Introduction to Artificial Intelligence	
CS 613	Machine Learning	
INFO 612	Knowledge-based Systems	
INFO 692	Explainable Artificial Intelligence	
Human-Centered Computing		
CS 661	Responsible Data Analysis	
CT 620	Security, Policy and Governance	
INFO 508	Information Innovation through Design Thinking	
INFO 590	Foundations of Data and Information	
INFO 608	Human-Computer Interaction	
INFO 615	Designing with Data	
INFO 616	Social and Collaborative Computing	
INFO 690	Understanding Users: User Experience Research Methods	
INFO 691	Prototyping the User Experience	
INFO 693	Human–Artificial Intelligence Interaction	
INFO 725	Information Policy and Ethics	
Computational		
Data Science and Analytics		
CS 660	Data Analysis at Scale	
CS 661	Responsible Data Analysis	
DSCI 511	Data Acquisition and Pre-Processing	
DSCI 521	Data Analysis and Interpretation	
DSCI 631	Applied Machine Learning for Data Science	
DSCI 632	Applied Cloud Computing	
INFO 546	Data Analytics for Community-Based Data and Service	
INFO 623	Social Network Analytics	

INFO 634	Data Mining
INFO 659	Introduction to Data Analytics
Algorithmic Foundations	
CS 521	Data Structures and Algorithms I
CS 522	Data Structures and Algorithms II
CS 525	Theory of Computation
CS 567	Applied Symbolic Computation
CS 618	Algorithmic Game Theory
CS 620	Advanced Data Structure and Algorithms
CS 621	Approximation Algorithms
CS 650	Program Generation and Optimization
DSCI 501	Quantitative Foundations of Data Science
ECES 521	Probability & Random Variables
ECES 523	Detection & Estimation Theory
MATH 504	Linear Algebra & Matrix Analysis
MATH 510	Applied Probability and Statistics I
Applications of AI/ML	
CS 614	Applications of Machine Learning
CS 583	Introduction to Computer Vision
CS 610	Advanced Artificial Intelligence
CS 611	Game Artificial Intelligence
CS 612	Knowledge-based Agents
CS 618	Algorithmic Game Theory
CS 630	Cognitive Systems
CS 634	Advanced Computer Vision
CS 770	Topics in Artificial Intelligence
DSCI 691	Natural Language Processing with Deep Learning
INFO 629	Applied Artificial Intelligence
INFO 693	Human–Artificial Intelligence Interaction
BMES 547	Machine Learning in Biomedical Applications
ECE 612	Applied Machine Learning Engineering
ECE 613	Neuromorphic Computing
Electives	**21.0**
The remaining 7 courses may be selected from any focal area listed above or any graduate course in CCI (CI, CS, CT, SE, DSCI, INFO). For the ComputationalAIML concentration, at least two (2) of these must be within the CS department.	
Up to two (2) of these may be approved independent studies.	
Total Credits	**45.0**

Sample Plan of Study

Part time, No co-op

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
Core Courses	6.0	Core Course	3.0	Breadth Courses	6.0	Electives	6.0
		Breadth Course	3.0				
	6		**6**		**6**		**6**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits
Electives	6.0	CS 591	3.0	CS 592	3.0
		Electives	6.0	Elective	3.0
	6		**9**		**6**

Total Credits 45

Full time, With Co-op

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
Core Courses	6.0	Core Course	3.0	Breadth Course	3.0	COOP EXPERIENCE	
Breadth Course	3.0	Breadth Course	3.0	Electives	6.0		
		Elective	3.0				
	9		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits
COOP EXPERIENCE		CS 591	3.0	CS 592	3.0
		Electives	6.0	Electives	6.0
	0		**9**		**9**

Total Credits 45

3675 Market Street

In March 2019, the College of Computing & Informatics relocated to 3675 Market (https://drexel.edu/cci/about/our-facilities/). For the first time in the College's history, all CCI faculty, students and professional staff are housed under one roof. Occupying two floors in the brand new uCity Square building, CCI's new home offers state-of-the-art technology in our classrooms, labs, meeting areas and collaboration spaces. 3675 Market offers Class A laboratory, office, coworking, and convening spaces. In fall 2019, the College opened a third floor which will include additional offices, classrooms, innovative research labs, and a maker space. Located at the intersection of Market Street and 37th Street, 3675 Market will act as a physical nexus, bridging academic campuses and medical centers to the east and south, the commercial corridors along Market Street and Chestnut Street, and the residential communities to the north and west.

The uCity Square building offers:

- Speculative lab/office space
- World-class facilities operated by CIC (https://cic.us/philadelphia/)
- Café/restaurant on-site
- Quorum, a two-story, 15K SF convening space and conference center
- Adjacent to future public square
- Access to Science Center’s nationally renowned business acceleration and technology commercialization programs

Drexel University Libraries

Drexel University Libraries (http://www.library.drexel.edu/) is a learning enterprise, advancing the University’s academic mission through serving as educators, supporting education and research, collaborating with researchers, and fostering intentional learning outside of the classroom. Drexel University Libraries engages with Drexel communities through three physical locations, including W. W. Hagerty Library, Queen Lane Library, and the Library Learning Terrace, as well as a vibrant online presence which sees, on average, over 8,000 visits per day. In the W.W. Hagerty Library location, College of Computing & Informatics students have access to private study rooms and nearly half a million books, periodicals, DVDs, videos and University Archives. All fields of inquiry are covered, including: library and information science, computer science, software engineering, health informatics, information systems, and computing technology. Resources are available online at library.drexel.edu (http://www.library.drexel.edu/) or in-person at W. W. Hagerty Library.

The Libraries also make available laptop and desktop PC and Mac computers, printers and scanners, spaces for quiet work or group projects and designated 24/7 spaces. Librarians and library staff—including a liaison librarian for computing and informatics—are available for individual research consultations and to answer questions about materials or services.

CCI Commons

Located on the 10th floor of 3675 Market Street, the CCI Commons is an open lab and collaborative work environment for students. It features desktop computers, a wireless/laptop area, free black and white printing, and more collaborative space for its students. Students have access to 3675 Market's fully equipped conference room with 42” displays and videoconferencing capabilities. The CCI Commons provides technical support to students, faculty, and professional staff. In addition, the staff provides audio-visual support for all presentation classrooms within 3675 Market. Use of the CCI Commons is reserved for all students taking CCI courses.

The computers for general use are Microsoft Windows and Macintosh OSX machines with appropriate applications which include the Microsoft Office suite, various database management systems, modeling tools, and statistical analysis software. Library related resources may be accessed at the CCI Commons and through the W.W. Hagerty Library. The College is a member of the Rational SEED Program which provides cutting-edge software development and project management software for usage in the CCI Commons and CCI classrooms. The College is also a member of the Microsoft Academic Alliance known also as “DreamSpark” that allows students free access to a wide array of Microsoft software titles and operating systems.

The CCI Commons, student labs, and classrooms have access to networked databases, print and file resources within the College, and the Internet via the University’s network. Email accounts, Internet and BannerWeb access are available through the Office of Information Resources and Technology.

CCI Learning Center

The CCI Learning Center (CLC), located in 3675 Market Street's CCI Commons student computer lab, provides consulting and other learning resources for students taking computer science classes. The CLC is staffed by graduate and undergraduate computer science students from the College of Computing & Informatics.

The CLC and CCI Commons serve as a central hub for small group work, student meetings, and TA assistance.

Research Laboratories

The College houses multiple research labs, led by CCI faculty, in 3675 Market Street including: the Drexel Health and Risk Communication Lab, Interactive Systems for Healthcare, Socio-Technical Studies Group, Intelligent Information & Knowledge Computing Research Lab, Evidence-based Decision Making Lab, Applied Symbolic Computation Laboratory (ASYM), High Performance Computing Laboratory (SPIRAL), Drexel Research on Play (RePlay) Laboratory, Software Engineering Research Group (SERG), Social Computing Research Group, Vision and Cognition Laboratory (VisCog) and the Vision and Graphics Laboratory. For more information on these laboratories, please visit the College's research web page (http://cci.drexel.edu/research.aspx).

Business Information Technology MSBIT

Major: Business Information Technology
Degree Awarded: Master of Science in Business Information Technology (MSBIT)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Classification of Instructional Programs (CIP) code: 52.0305
Standard Occupational Classification (SOC) code: 11-3031

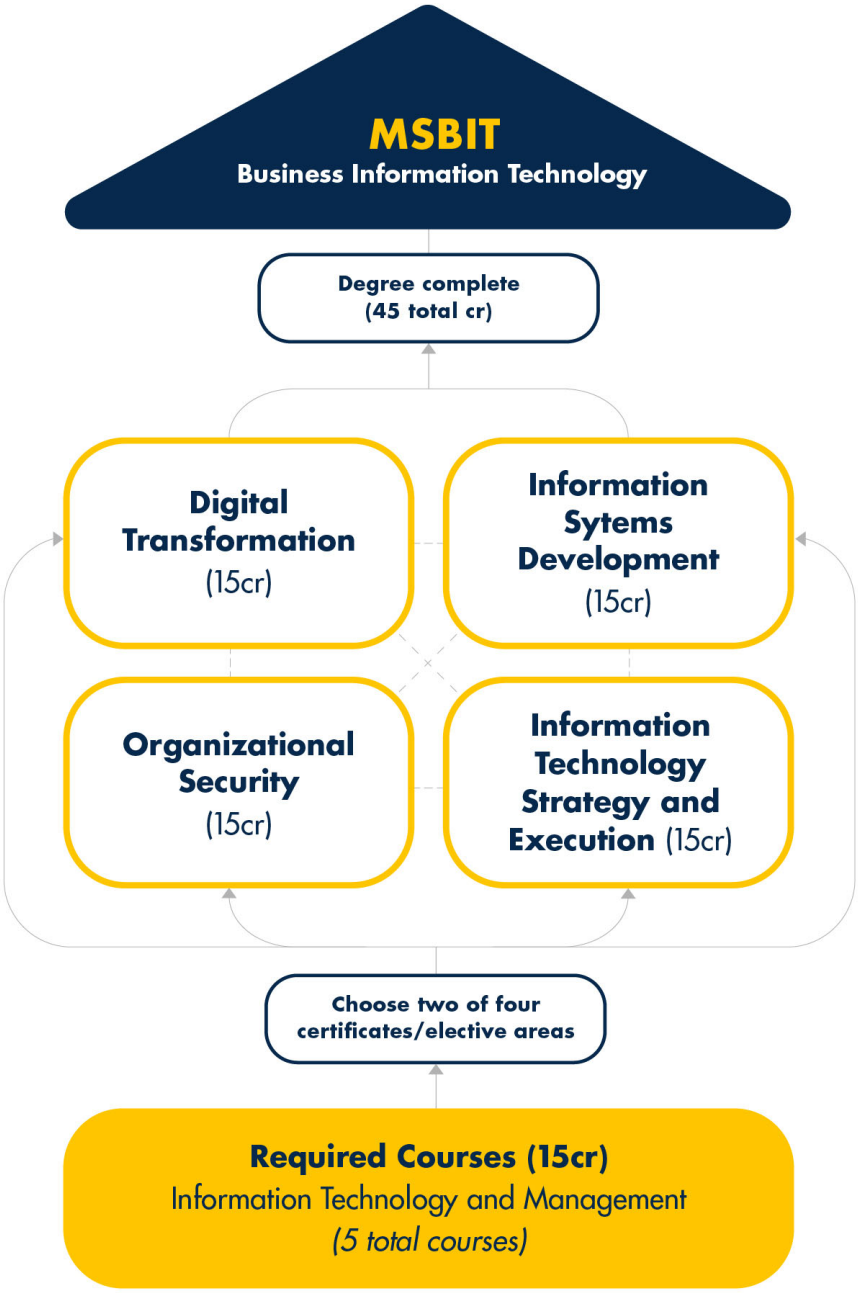
About the Program

The Master of Science in Business Information Technology (MSBIT) prepares students for work related to applying information technology in organizations. Jointly offered by the College of Computing & Informatics and the LeBow College of Business, the program is thoroughly interdisciplinary. It connects business and information technology perspectives so that students understand information technology in an organizational context. Specifically, students completing the program will understand how information technology is managed in an organizational environment, how it helps to solve organizational problems, and how it can be used to transform an organization.

The program is designed for students who have relevant work experience and either a technical or a business background. Courses provide technology and business knowledge with a practical emphasis. To complement required foundations in information technology and management, students can choose to focus on two of the following areas: organizational security, information technology and execution, information systems development, or digital transformation.

Pathways to Completion

As the graphic below indicates, students have different pathways to earning the MSBIT.



Degree Requirements

Required Courses - Information Technology & Management		
CT 500	Introduction to the Digital Environment	3.0
CT 600	Cloud Technology	3.0
CT 610	Disaster Recovery, Continuity Planning and Digital Risk Assessment	3.0
MIS 615	Aligning Information Technologies and Operations	3.0
MIS 625	Management of Information Technology Operations	3.0
Choose 2 of the following elective areas		**30.0**
Organizational Security		
CT 605	Cloud Security and Virtual Environments	
CT 620	Security, Policy and Governance	

INFO 517	Principles of Cybersecurity
INFO 710	Information Forensics
INFO 712	Information Assurance
Information Technology Strategy & Execution	
MIS 612	Aligning Information Systems and Business Strategies
MIS 641	MIS Policy and Strategy
ORGB 602	Leading and Executing Change
SE 630	Software Engineering Economics
SE 638	Software Project Management
Information Sytems Development	
CT 630	Application Software Construction and Operation
INFO 540	Perspectives on Information Systems
INFO 605	Database Management Systems
MIS 624	Systems Analysis & Design
MIS 652	Business Agility and IT
Digital Transformation	
MGMT 602	Innovation Management
MGMT 603	Technology Strategy
MIS 642	Emerging Information Technologies in Business
MIS 643	Digital Platform Management
MIS 653	Design Thinking for Digital Innovations
Total Credits	**45.0**

Sample Plan of Study

First Year

Fall	Credits Winter	Credits Spring	Credits Summer	Credits
CT 500	3.0 CT 600	3.0 CT 610	3.0 MIS 615	3.0
Elective Area 1	3.0 Elective Area 2	3.0 Elective Area 1	3.0 Elective Area 2	3.0
	6	**6**	**6**	**6**

Second Year

Fall	Credits Winter	Credits Spring	Credits
MIS 625	3.0 Elective Area 1	3.0 Elective Area 1	3.0
Elective Area 1	3.0 Elective Area 2	3.0 Elective Area 2	6.0
	6	**6**	**9**

Total Credits 45

Business Information Technology Faculty

Murugan Anandarajan, PhD *(Drexel University) Senior Associate Dean for Academic Affairs*. Professor. Cyber crime, strategic management of information technology, unstructured data mining, individual internet usage behavior (specifically abuse and addiction), application of artificial intelligence techniques in forensic accounting and ophthalmology.

Orakwue B. Arinze, PhD *(London School of Economics)*. Professor. Client/Server computing; Enterprise Application Software (EAS)/Enterprise Resource Planning Software (ERP); knowledge-based and decision support applications in operations management.

Christopher Carroll, MS *(Drexel University) BSCST Program Director*. Associate Teaching Professor. Information technology within healthcare companies, computer networking and design, IT infrastructure, server technology, information security, virtualization and cloud computing.

Michael Chu, MSE *(University of Pennsylvania)*. Associate Teaching Professor. System, server, computer networking and design; IT infrastructure; information technology management and security; Web system programming; database and mobile application development.

Qizhi Dai, PhD *(University of Minnesota)*. Associate Professor. Business Value of Information Technology, eCommerce, Economics of Information Technology, Information System Management.

David Gefen, PhD *(Georgia State University) Provost Distinguished Research Professor*. Professor. Strategic IT management; IT development and implementation management; research methodology; managing the adoption of large IT systems, such as MRP II, ERP, and expert systems; research methodology, eCommerce; Online Auctions; Outsourcing; SAS; Technology Adoption.

Peter Grillo, PhD *(Temple University) Associate Department Head for Undergraduate Affairs, Information Science*. Teaching Professor. Software economics, Project management, Strategic applications of technology within organizations.

Thomas Heverin, PhD *(Drexel University)*. Associate Teaching Professor. Computer security, ethical hacking, computer forensics, network forensics, cloud security and cybersecurity.

David Kurz, EdD *(University of Pennsylvania)*. Associate Clinical Professor. Business Education; Groups/Teams; Leadership; Supply Chain Leadership.

V. K. Narayanan, PhD *(University of Pittsburgh)*. Delloitte Touche Jones Stubbs Professor. Cognition and Strategy; Corporate Entrepreneurship; Organization design

Arjan Raven, PhD *(University of Southern California)*. Associate Clinical Professor. Department of Decision Sciences & MIS. Neuro-Information-Systems, task-technology fit, web-based

Samir Shah, DPS *(Pace University)*. Clinical Professor. Drexel University's Provost Fellow India Partnerships

Computer Science

Major: Computer Science
Degree Awarded: Master of Science in Computer Science (MSCS)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: Available for full-time, on-campus master's-level students
Classification of Instructional Programs (CIP) code: 11.0701
Standard Occupational Classification (SOC) code: 11-3021; 15-1111; 15-1131; 15-1132; 15-1199

About the Program

The Department of Computer Science in the College of Computing & Informatics (https://drexel.edu/cci/) houses research groups actively conducting research on a wide range of topics in Computer Science including artificial intelligence, algorithms, computer vision and graphics, programming languages, networks, privacy and security, high-performance computing, software engineering, computer algebra, and algorithms. The department emphasizes both interdisciplinary and applied research and is supported by major federal research grants from the National Science Foundation, Department of Defense, Department of Energy, and the National Institute of Standards and Technology, as well as by private sources.

The Master of Science in Computer Science program is designed to provide breadth of understanding in the core topics of computer science, in-depth advanced material, and a range of topics in the research areas of the faculty. A balance of theory and practice is presented, preparing students to perform cutting-edge research as well as training students to become practicing computer scientists or software engineers in business, industry, or government. A thesis option is available to prepare students for doctoral studies or other research-oriented career paths.

The program provides room for electives outside of Computer Science in an area which the student wishes to apply their computing skills and from the Post-Baccalaureate Certificate in Computer Science (p. 41) (for those with an insufficient Computer Science background).

A graduate co-op is available; for more information, visit the Steinbright Career Development Center's website (http://www.drexel.edu/scdc/co-op/graduate/).

Additional Information

For more information about the Master of Science in Computer Science degree program, including admission requirements, visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/computer-science/ms-in-computer-science/).

Master of Science in Computer Science

Students must complete a minimum of 45.0 graduate credits for the MS degree.

Core Requirements		
Students must take 1 course from each pair		
CS 500	Fundamentals of Databases	3.0
or CS 510	Introduction to Artificial Intelligence	
CS 521	Data Structures and Algorithms I	3.0
or CS 525	Theory of Computation	
CS 530	Developing User Interfaces	3.0
or CS 540	High Performance Computing	
CS 536	Computer Graphics	3.0
or CS 583	Introduction to Computer Vision	
CS 543	Operating Systems	3.0
or CS 544	Computer Networks	
CS 550	Programming Languages	3.0
or SE 575	Software Design	

Major Electives		**15.0**
Students must take an additional 5 CS-related courses from the following categories		
From the courses listed below, excluding any courses taken to fulfill a core requirement and spanning at least 2 categories		
Theory		
CS 521	Data Structures and Algorithms I (Core Candidate)	
CS 522	Data Structures and Algorithms II	
CS 525	Theory of Computation (Core Candidate)	
CS 618	Algorithmic Game Theory	
CS 620	Advanced Data Structure and Algorithms	
CS 621	Approximation Algorithms	
CS 623	Computational Geometry	
Intelligent Systems		
CS 500	Fundamentals of Databases (Core Candidate)	
CS 510	Introduction to Artificial Intelligence (Core Candidate)	
CS 511	Robot Laboratory	
CS 610	Advanced Artificial Intelligence	
CS 611	Game Artificial Intelligence	
CS 612	Knowledge-based Agents	
CS 613	Machine Learning	
CS 615	Deep Learning	
CS 660	Data Analysis at Scale	
CS 661	Responsible Data Analysis	
Programming Systems		
CS 550	Programming Languages (Core Candidate)	
CS 650	Program Generation and Optimization	
CS 675	Reverse Software Engineering	
CS 676	Parallel Programming	
SE 575	Software Design (Core Candidate)	
SE 576	Software Reliability and Testing	
SE 577	Software Architecture	
SE 578	Security Engineering	
Computer Systems		
CS 543	Operating Systems (Core Candidate)	
CS 544	Computer Networks (Core Candidate)	
CS 643	Advanced Operating Systems	
CS 645	Network Security	
CS 647	Distributed Systems Software	
Vision and Graphics		
CS 536	Computer Graphics (Core Candidate)	
CS 537	Interactive Computer Graphics	
CS 558	Game Engine Programming	
CS 583	Introduction to Computer Vision (Core Candidate)	
CS 634	Advanced Computer Vision	
CS 636	Advanced Computer Graphics	
Applications		
CS 530	Developing User Interfaces (Core Candidate)	
CS 540	High Performance Computing (Core Candidate)	
CS 567	Applied Symbolic Computation	
CS 590	Privacy	
CS 630	Cognitive Systems	
CS 668	Computer Algebra I	
CS 669	Computer Algebra II	
From MSSE Core Courses		
SE 575	Software Design	
SE 576	Software Reliability and Testing	
SE 627	Requirements Engineering and Management	
SE 638	Software Project Management	
From the following MSDS Core Courses		
DSCI 511	Data Acquisition and Pre-Processing	
DSCI 521	Data Analysis and Interpretation	
Additional Graduate-Level Courses		**12.0**
4 additional graduate level courses are required, which could be:		

Up to 6 credits for the thesis option	
Up to 2 CS Independent Studies	
Additional approriate graduate level Computer Science, Software Engineering, Data Science or Artificial Intelligence courses, consulting with your advisor courses	
Up to 2 appropriate graduate-level computing-related courses outside of Computer Science, Software Engineering, Data Science and Artificial Intelligence approved by the College	
From the core courses from the CS-PBC	
CS 501	Introduction to Programming
CS 502	Data Structures and Algorithms
CS 503	Systems Basics
CS 504	Introduction to Software Design
Total Credits	**45.0**

Sample Plan of Study (MSCS)

First Year

Fall	**Credits Winter**	**Credits Spring**	**Credits Summer**	**Credits**
Core Courses	6.0 Core Courses	6.0 Core Courses	6.0 Major Electives	6.0
	6	**6**	**6**	**6**
Second Year				
Fall	**Credits Winter**	**Credits Spring**	**Credits Summer**	**Credits**
Major Electives	6.0 Major Elective	3.0 Electives	6.0 Elective	3.0
	Elective	3.0		
	6	**6**	**6**	**3**

Total Credits 45

Note: Second Year Summer is less than the 4.5-credit minimum required (considered half-time status) of graduate programs to be considered financial aid eligible. As a result, aid will not be disbursed to students this term.

Dual Degree Opportunities

Graduate students already enrolled in a master's degree program at Drexel have the opportunity, through the dual master's program, to work simultaneously on two CCI master's degrees and to receive both upon graduation. To be eligible, graduate students must be currently working on their first CCI master's degree when requesting admission to the second CCI master's degree. They must obtain approval from the graduate advisors of both programs and work out a plan of study encompassing coursework and/or research (thesis) credits for both degrees.

Some courses may be used to satisfy requirements in both degrees, reducing the total number of courses taken, according to Drexel’s Dual MS Degree Policy. The dual degree for MSCS students is only available to on-campus students. Please contact your advisor (https://drexel.edu/cci/current-students/graduate-professional-development/advising/) for more information on program requirements as some CCI master's degree combinations may require additional prerequisites.

The dual master's student must complete the Change of Curriculum and Status form (https://drexel.edu/graduatecollege/forms-policies/forms/) and obtain approvals from both graduate advisors. Final approval is granted by the Graduate College (http://drexel.edu/graduatecollege/). The student is then registered in both majors simultaneously. Upon graduation, the student must file two Application for Degree (http://drexel.edu/drexelcentral/graduation/information/applying-for-degree/) forms.

3675 Market Street

In March 2019, the College of Computing & Informatics relocated to 3675 Market (https://drexel.edu/cci/about/our-facilities/). For the first time in the College's history, all CCI faculty, students and professional staff are housed under one roof. Occupying two floors in the brand new uCity Square building, CCI's new home offers state-of-the-art technology in our classrooms, labs, meeting areas and collaboration spaces. 3675 Market offers Class A laboratory, office, coworking, and convening spaces. In fall 2019, the College opened a third floor which will include additional offices, classrooms, innovative research labs, and a maker space. Located at the intersection of Market Street and 37th Street, 3675 Market will act as a physical nexus, bridging academic campuses and medical centers to the east and south, the commercial corridors along Market Street and Chestnut Street, and the residential communities to the north and west.

The uCity Square building offers:

- Speculative lab/office space
- World-class facilities operated by CIC (https://cic.us/philadelphia/)
- Café/restaurant on-site
- Quorum, a two-story, 15K SF convening space and conference center

- Adjacent to future public square
- Access to Science Center's nationally renowned business acceleration and technology commercialization programs

Drexel University Libraries

Drexel University Libraries (http://www.library.drexel.edu/) is a learning enterprise, advancing the University's academic mission through serving as educators, supporting education and research, collaborating with researchers, and fostering intentional learning outside of the classroom. Drexel University Libraries engages with Drexel communities through three physical locations, including W. W. Hagerty Library, Queen Lane Library, and the Library Learning Terrace, as well as a vibrant online presence which sees, on average, over 8,000 visits per day. In the W.W. Hagerty Library location, College of Computing & Informatics students have access to private study rooms and nearly half a million books, periodicals, DVDs, videos and University Archives. All fields of inquiry are covered, including: library and information science, computer science, software engineering, health informatics, information systems, and computing technology. Resources are available online at library.drexel.edu (http://www.library.drexel.edu/) or in-person at W. W. Hagerty Library.

The Libraries also make available laptop and desktop PC and Mac computers, printers and scanners, spaces for quiet work or group projects and designated 24/7 spaces. Librarians and library staff—including a liaison librarian for computing and informatics—are available for individual research consultations and to answer questions about materials or services.

CCI Commons

Located on the 10th floor of 3675 Market Street, the CCI Commons is an open lab and collaborative work environment for students. It features desktop computers, a wireless/laptop area, free black and white printing, and more collaborative space for its students. Students have access to 3675 Market's fully equipped conference room with 42" displays and videoconferencing capabilities. The CCI Commons provides technical support to students, faculty, and professional staff. In addition, the staff provides audio-visual support for all presentation classrooms within 3675 Market. Use of the CCI Commons is reserved for all students taking CCI courses.

The computers for general use are Microsoft Windows and Macintosh OSX machines with appropriate applications which include the Microsoft Office suite, various database management systems, modeling tools, and statistical analysis software. Library related resources may be accessed at the CCI Commons and through the W.W. Hagerty Library. The College is a member of the Rational SEED Program which provides cutting-edge software development and project management software for usage in the CCI Commons and CCI classrooms. The College is also a member of the Microsoft Academic Alliance known also as "DreamSpark" that allows students free access to a wide array of Microsoft software titles and operating systems.

The CCI Commons, student labs, and classrooms have access to networked databases, print and file resources within the College, and the Internet via the University's network. Email accounts, Internet and BannerWeb access are available through the Office of Information Resources and Technology.

CCI Learning Center

The CCI Learning Center (CLC), located in 3675 Market Street's CCI Commons student computer lab, provides consulting and other learning resources for students taking computer science classes. The CLC is staffed by graduate and undergraduate computer science students from the College of Computing & Informatics.

The CLC and CCI Commons serve as a central hub for small group work, student meetings, and TA assistance.

Research Laboratories

The College houses multiple research labs, led by CCI faculty, in 3675 Market Street including: the Drexel Health and Risk Communication Lab, Interactive Systems for Healthcare, Socio-Technical Studies Group, Intelligent Information & Knowledge Computing Research Lab, Evidence-based Decision Making Lab, Applied Symbolic Computation Laboratory (ASYM), High Performance Computing Laboratory (SPIRAL), Drexel Research on Play (RePlay) Laboratory, Software Engineering Research Group (SERG), Social Computing Research Group, Vision and Cognition Laboratory (VisCog) and the Vision and Graphics Laboratory. For more information on these laboratories, please visit the College's research web page (http://cci.drexel.edu/research.aspx).

Computer Science PhD

Major: Computer Science
Degree Awarded: Doctor of Philosophy (PhD)
Calendar Type: Quarter
Minimum Required Credits: 48.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 11.0701
Standard Occupational Classification (SOC) code: 11-3021; 15-1111; 15-1131; 15-1132; 15-1199

About the Program

Students enrolled in the PhD in Computer Science program are expected to become an expert in a research area in computer science or a related interdisciplinary field. They are expected to conduct research in considerable depth and make substantial contributions through creative research and serious scholarship. The program is designed for students to ensure core knowledge of the fundamental computer science areas and to conduct cutting-edge research at the forefront of a selected area. Students are prepared for computer science leadership careers in industry, research, government and education and interdisciplinary work using computer science.

Additional Information

For more information about these programs, including admission requirements, visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/doctoral-programs/phd-computer-science/).

Degree Requirements

Students in the PhD program move through several milestones on their way to completion of the degree: (1) qualifying requirements in which the student takes courses to ensure breadth and depth of knowledge across areas of computer science; (2) a candidacy exam in which the student performs an in-depth study of a particular area of research; (3) a thesis proposal in which the student provides a detailed overview of their planned dissertation work; and finally (4) a thesis defense in which the student presents their completed dissertation work. Upon entering the PhD program, students work with a Graduate Advisor to develop a plan of study (filed no later than the end of the first term); this plan can be revised and brought up-to-date when necessary, and serves as a blueprint for planning out the timely and successful completion of all milestones.

Breadth Requirements		**12.0**
Students must take 4 courses from the list below, with at least 1 course from each category.		
Theory		
CS 521	Data Structures and Algorithms I	
CS 525	Theory of Computation	
Systems		
CS 543	Operating Systems	
CS 544	Computer Networks	
CS 550	Programming Languages	
SE 575	Software Design	
Applications		
CS 500	Fundamentals of Databases	
CS 510	Introduction to Artificial Intelligence	
CS 523	Cryptography	
CS 530	Developing User Interfaces	
CS 536	Computer Graphics	
CS 540	High Performance Computing	
CS 558	Game Engine Programming	
CS 567	Applied Symbolic Computation	
CS 583	Introduction to Computer Vision	
CS 590	Privacy	
SE 578	Security Engineering	
Depth Requirement		**12.0**
Students must take 4 additional Computer Science (CS) courses at the 500 level or higher. Related courses (e.g., Software Engineering) may be designated to fulfill these requirements with departmental permission.		
Research		**66.0-111.0**
CS I999	Independent Study in CS	
CS 997	Research in Computer Science	
CS 998	Ph.D. Dissertation	
Total Credits		**90.0-135.0**

All PhD students must take 4 courses as part of the Breadth Requirements, and an additional 4 courses as part of the Depth Requirements. Students must pass each of the 4 Breadth courses with a grade of B+ or higher and must achieve a GPA of 3.5 or higher across all 8 courses. Normally, a student will satisfy the Breadth Requirements by the end of their first year in the program and will satisfy the Depth Requirements by the end of their second year.

- If a student fails to meet the minimum grade or GPA requirements above, the department will require supplemental remediation on a case-by-case basis that may include any of the following: (1) take another Breadth course in the same category and obtain a grade of B+ or higher; (2) retake the same course at the next offering and obtain a grade of B+ or higher; or (3) retake the final exam of the same course with permission of the instructor and obtain a grade of B+ or higher. Failure to satisfy the required remediation will lead to termination from the PhD program.

- If a student feels that they have already mastered the material in any of the Breadth categories (Theory, Systems, or Applications) — for example, from prior coursework or work experience —they may choose to satisfy the requirement in that category by taking an advanced course in the same category, and by receiving a grade of B+ or higher in the advanced course. Students should discuss their situation with the department as early as possible, and the department can provide potential options for advanced courses in that category. In all cases, students must obtain departmental approval before enrolling in or starting any advanced course that will be used to satisfy the Breadth Requirements.

- Transfer credits may not be used for Breadth Requirements but may be used for Depth Requirements. (If transfer credits are used, the GPA for purposes of qualifying is calculated only from Breadth and Depth courses taken while enrolled in the PhD program.) Thus, incoming students with a prior MS degree or prior graduate-level coursework may be able to transfer up to 4 prior courses into the PhD program to satisfy the Depth Requirements. However, because transfer credits cannot be used for Breadth Requirements, all students must take a minimum of 4 courses as part of the PhD program, regardless of prior coursework.

Sample Plan of Study

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
CS 510	3.0	CS 543	3.0	CS 583	3.0	VACATION	
CS 521	3.0	CS 997	6.0	CS 997	6.0		
CS 997	3.0						
	9		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
CS 536	3.0	CS 615	3.0	CS 645	3.0	VACATION	
CS 613	3.0	CS 997	3.0	CS 997	3.0		
CS 997	3.0	CS I999 (Candidacy exam prep)	3.0	CS I999 (Candidacy exam prep)	3.0		
	9		**9**		**9**		**0**

Third Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
CS 997	9.0	CS 997	9.0	CS 997	6.0	VACATION	
				CS 998	3.0		
	9		**9**		**9**		**0**

Fourth Year

Fall	Credits
CS 997	6.0
CS 998	3.0
	9

Total Credits 90

Facilities

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Computer Security and Privacy

Major: Computer Security and Privacy
Degree Awarded: Master of Science in Computer Security and Privacy (MSCSP)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: Available for full-time, on-campus master's-level students
Classification of Instructional Programs (CIP) code: 11.1003
Standard Occupational Classification (SOC) code: 11-3021; 15-1212; 15-1231; 15-1241; 15-1242; 15-1243; 15-1244

About the Program

Information technology and data have dominated physical, economic, health, and cultural aspects of the modern world. For example, information technology and data run electronic commerce and global finance; control critical infrastructure that supply water, electrical power and food; and comprise the Internet of Things, which range from smartphones to home appliances and to medical implanted devices.

The great advantages that information technology and data bring are, unfortunately, susceptible to malicious actors, ranging from amateur hackers to hostile nation states, who try to circumvent the mechanisms and policies that are designed to protect computers and data. Stories involving malware, such as ransomware and botnets, infecting government, corporate, critical infrastructure, small businesses and even home networks are now common news.

The MS in Computer Security and Privacy aims to educate students in the science, technology, and policies that are essential to protecting information technology and data. The degree aims to establish the computer science and software engineering system fundamentals needed by the modern security expert, in addition to how these fundamentals, when combined with expert courses in computer security and privacy, lead to a well-rounded education in the domain of computer security and privacy.

Additional Information

For more information about the Master of Science in Computer Security and Privacy degree program, visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/).

Admission Requirements

The Master of Science in Computer Security and Privacy accepts applicants who hold a bachelor's degree from an accredited university. Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/) for more information on admission requirements.

Degree Requirements

Foundation Courses or Additional Electives		**12.0**
Foundation Courses for Students without a CS or SE Background (0-12 credits)		
CS 501	Introduction to Programming	
CS 502	Data Structures and Algorithms	
CS 503	Systems Basics	
CS 504	Introduction to Software Design	
Electives CS and SE Courses that can be taken in lieu of Foundation Courses (0-12 credits)		
CS 510	Introduction to Artificial Intelligence	
CS 643	Advanced Operating Systems	
CS 647	Distributed Systems Software	
CS 660	Data Analysis at Scale	
SE 575	Software Design	
SE 576	Software Reliability and Testing	
SE 577	Software Architecture	
Required CS Courses		
CS 543	Operating Systems	3.0
CS 544	Computer Networks	3.0
CS 613	Machine Learning	3.0
CS 615	Deep Learning	3.0
Required Security & Privacy Courses		
CS 523	Cryptography	3.0
CS 590	Privacy	3.0
CS 645	Network Security	3.0
CT 605	Cloud Security and Virtual Environments	3.0
CT 620	Security, Policy and Governance	3.0
INFO 710	Information Forensics	3.0
SE 578	Security Engineering	3.0
Total Credits		**45.0**

Sample Plan of Study

No Co-op option

First Year

Fall	Credits Winter	Credits Spring	Credits Summer	Credits
CS 510	3.0 CS 543	3.0 CS 544	3.0 CS 523	3.0
SE 575	3.0 SE 576	3.0 SE 577	3.0 CT 605	3.0
	6	**6**	**6**	**6**

Second Year

Fall	Credits Winter	Credits Spring	Credits Summer	Credits
CS 613	3.0 CS 590	3.0 CS 645	3.0 CS 615	3.0

CT 620	3.0 SE 578	3.0 INFO 710	3.0	
	6	**6**	**6**	**3**

Total Credits 45

Full-time, Graduate Co-op option

First Year

Fall	Credits Winter	Credits Spring	Credits Summer	Credits
CS 510	3.0 CS 523	3.0 CS 544	3.0 Co-op	
CT 620	3.0 CS 543	3.0 CS 613	3.0	
SE 575	3.0 SE 576	3.0 SE 577	3.0	
	9	**9**	**9**	**0**

Second Year

Fall	Credits Winter	Credits Spring	Credits
Co-op	CS 590	3.0 CS 645	3.0
	CS 615	3.0 CT 605	3.0
	SE 578	3.0 INFO 710	3.0
	0	**9**	**9**

Total Credits 45

Data Science

Major: Data Science
Degree Awarded: Master of Science in Data Science (MSDS)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: Graduate Co-op
Classification of Instructional Programs (CIP) code: 11.0199
Standard Occupational Classification (SOC) code: 15-1111

About the Program

The Master of Science in Data Science program provides a strong foundation in the emerging area of data science with foci on data management and accountability, visualization and communication, and computational, algorithmic, and applied processing techniques. Students gain competency in fundamental methods and techniques for data collection, management, analysis, and result interpretation. Their fundamental understanding and skills will be applied to real-world data analysis tasks through state-of-the-art technologies, tools, and platforms.

Admission Requirements

The Master of Science in Data Science accepts applicants who hold a bachelor's degree from an accredited university. Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/data-science/ms-in-data-science/) for more information on admission requirements.

Additional Information

For more information, please visit the College of Computing & Informatics (CCI) website (https://drexel.edu/cci/academics/graduate-programs/data-science/ms-in-data-science/).

Degree Requirements

Required Core Courses		
DSCI 511	Data Acquisition and Pre-Processing	3.0
DSCI 521	Data Analysis and Interpretation	3.0
DSCI 591	Data Science Capstone I	3.0
DSCI 592	Data Science Capstone II	3.0
DSCI 631	Applied Machine Learning for Data Science	3.0
DSCI 632	Applied Cloud Computing	3.0
Analytics Electives		**6.0**
Choose 2 of the following:		
CS 510	Introduction to Artificial Intelligence	
CS 583	Introduction to Computer Vision	
CS 613	Machine Learning	
CS 615	Deep Learning	
CS 660	Data Analysis at Scale	

DSCI 501	Quantitative Foundations of Data Science	
DSCI 691	Natural Language Processing with Deep Learning	
INFO 623	Social Network Analytics	
INFO 624	Information Retrieval Systems	
INFO 659	Introduction to Data Analytics	
Algorithms Elective		**3.0**
Choose 1 of the following:		
CS 521	Data Structures and Algorithms I	
CS 540	High Performance Computing	
CS 570	Programming Foundations	
CS 647	Distributed Systems Software	
CS 676	Parallel Programming	
Visualization and Communication Elective		**3.0**
Choose 1 of the following:		
CS 530	Developing User Interfaces	
CS 537	Interactive Computer Graphics	
CS 630	Cognitive Systems	
INFO 608	Human-Computer Interaction	
INFO 633	Information Visualization	
INFO 648	Healthcare Informatics	
INFO 690	Understanding Users: User Experience Research Methods	
INFO 691	Prototyping the User Experience	
INFO 725	Information Policy and Ethics	
Management and Accountability Elective		**3.0**
Choose 1 of the following:		
CS 500	Fundamentals of Databases	
CS 590	Privacy	
CS 661	Responsible Data Analysis	
CT 500	Introduction to the Digital Environment	
CT 600	Cloud Technology	
CT 605	Cloud Security and Virtual Environments	
CT 610	Disaster Recovery, Continuity Planning and Digital Risk Assessment	
CT 620	Security, Policy and Governance	
INFO 590	Foundations of Data and Information	
INFO 591	Data and Digital Stewardship	
INFO 605	Database Management Systems	
INFO 606	Advanced Database Management	
INFO 607	Applied Database Technologies	
INFO 646	Information Systems Management	
INFO 662	Metadata and Resource Description	
INFO 712	Information Assurance	
SE 578	Security Engineering	
Additional Electives		**12.0**
Choose 4 courses from:		
The above elective areas not used to fulfill the concentration requirement		
Additional appropriate graduate level Computer Science, Software Engineering, or Artificial Intelligence courses with subject codes CS and SE, consulting with your advisor		
Up to 2 appropriate graduate-level computing-related courses outside of Computer Science, Software Engineering, and Artificial Intelligence approved by the College		
Total Credits		**45.0**

Sample Plan of Study

First Year

Fall	Credits Winter	Credits Spring	Credits Summer	Credits
CS 570	3.0 DSCI 501	3.0 DSCI 631	3.0 DSCI 632	3.0
DSCI 511	3.0 DSCI 521	3.0 Analytics Elective	3.0 Algorithms Elective	3.0
	6	**6**	**6**	**6**

Second Year

Fall	Credits Winter	Credits Spring	Credits Summer	Credits
Visualization and Communication Elective	3.0 Analytics Elective	3.0 DSCI 591	3.0 DSCI 592	3.0

Management and Accountability Elective	3.0 Elective	3.0 Elective	3.0	
	6	**6**	**6**	**3**

Total Credits 45

Note: Second Year Summer is less than the 4.5-credit minimum required (considered half-time status) of graduate programs to be considered financial aid eligible. As a result, aid will not be disbursed to students this term.

Facilities

3675 Market Street

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The uCity Square building offers:

- Speculative lab/office space
- World-class facilities operated by CIC (https://cic.us/philadelphia/)
- Café/restaurant on-site
- Quorum, a two-story, 15K SF convening space and conference center
- Adjacent to future public square
- Access to Science Center’s nationally renowned business acceleration and technology commercialization programs

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The Libraries also make available laptop and desktop PC and Mac computers, printers and scanners, spaces for quiet work or group projects and designated 24/7 spaces. Librarians and library staff—including a liaison librarian for computing and informatics—are available for individual research consultations and to answer questions about materials or services.

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The computers for general use are Microsoft Windows and Macintosh OSX machines with appropriate applications which include the Microsoft Office suite, various database management systems, modeling tools, and statistical analysis software. Library related resources may be accessed at the CCI Commons and through the W.W. Hagerty Library. The College is a member of the Rational SEED Program which provides cutting-edge software development and project management software for usage in the CCI Commons and CCI classrooms. The College is also a member of the Microsoft Academic Alliance known also as “DreamSpark” that allows students free access to a wide array of Microsoft software titles and operating systems.

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CCI Learning Center

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The CLC and CCI Commons serve as a central hub for small group work, student meetings, and TA assistance.

Research Laboratories

The College houses multiple research labs, led by CCI faculty, in 3675 Market Street including: the Drexel Health and Risk Communication Lab, Interactive Systems for Healthcare, Socio-Technical Studies Group, Intelligent Information & Knowledge Computing Research Lab, Evidence-based Decision Making Lab, Applied Symbolic Computation Laboratory (ASYM), High Performance Computing Laboratory (SPIRAL), Drexel Research on Play (RePlay) Laboratory, Software Engineering Research Group (SERG), Social Computing Research Group, Vision and Cognition Laboratory (VisCog) and the Vision and Graphics Laboratory. For more information on these laboratories, please visit the College's research web page (http://cci.drexel.edu/research.aspx).

Human-Computer Interaction and User Experience

Major: Human-Computer Interaction and User Experience
Degree Awarded: Master of Science in Information (MSI)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 30.3101
Standard Occupational Classification (SOC) code: 15-1210

About the Program

Human-Computer Interaction and User Experience (HCI/UX) is a graduate major that explores creative ideas, theories, and technologies to advance students' understanding of the complex and tightly coupled relationships between people and computing systems. The program prepares students to create and evaluate technologies that support and complement human needs and abilities in a broad range of contexts such as work, wellness, home, entertainment, and artistic expression. The HCI/UX major is part of the Master of Science in Information (MSI), which prepares students for a range of careers related to user experience research, interface design, and software development.

Admission Requirements

The Master of Science in Information accepts applicants who hold a bachelor's degree from an accredited university. Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/human-computer-interaction-ux/human-computer-interaction-ux-major/) for more information on admission requirements.

Additional Information

For more information about this program, visit the College of Computing & Informatics MS in Information - Human-Computer Interaction & User Experience (https://drexel.edu/cci/academics/graduate-programs/human-computer-interaction-ux/human-computer-interaction-ux-major/) webpage.

Degree Requirements

Foundation Courses		
INFO 505	Information Professionals and Information Ethics	3.0
INFO 508	Information Innovation through Design Thinking	3.0
or DSRE 620	Design Problem Solving	
INFO 590	Foundations of Data and Information	3.0
Core Courses		
INFO 608	Human-Computer Interaction	3.0
INFO 615	Designing with Data	3.0
INFO 616	Social and Collaborative Computing	3.0
INFO 690	Understanding Users: User Experience Research Methods	3.0
INFO 691	Prototyping the User Experience	3.0
Elective Courses		**15.0**
Choose 5 of the following; additional courses may be approved by an advisor:		
AS-I 501	Creative Interdisciplinary Team Research: Principles and Practice	
CS 502	Data Structures and Algorithms	
CS 570	Programming Foundations	
or CS 501	Introduction to Programming	

DIGM 501	New Media: History, Theory and Methods	
INFO 532	Software Development	
INFO 540	Perspectives on Information Systems	
INFO 623	Social Network Analytics	
INFO 629	Applied Artificial Intelligence	
INFO 633	Information Visualization	
INFO 659	Introduction to Data Analytics	
INFO 682	Storytelling	
INFO 693	Human–Artificial Intelligence Interaction	
INFO 725	Information Policy and Ethics	
MKTG 601	Marketing Strategy & Planning	
SE 638	Software Project Management	
Capstone Project		
INFO 890	Capstone Project	6.0
Total Credits		**45.0**

Sample Plan of Study

Part-time

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
INFO 505	3.0	INFO 590	3.0	INFO 690	3.0	INFO 615	3.0
INFO 508 or DSRE 620	3.0	INFO 608	3.0	INFO 691	3.0	INFO 616	3.0
	6		**6**		**6**		**6**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits
Electives	6.0	INFO 890	3.0	INFO 890	3.0
		Electives	6.0	Elective	3.0
	6		**9**		**6**

Total Credits 45

Full-time

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
INFO 505	3.0	INFO 590	3.0	INFO 690	3.0	INFO 615	3.0
INFO 508 or DSRE 620	3.0	INFO 608	3.0	INFO 691	3.0	INFO 616	3.0
Elective	3.0	Elective	3.0	Elective	3.0	INFO 890	3.0
	9		**9**		**9**		**9**

Second Year

Fall	Credits
INFO 890	3.0
Electives	6.0
	9

Total Credits 45

Evaluations

The College of Computing & Informatics works continually to improve its degree programs. As part of this effort, the Human-Computer Interaction and User Experience graduate major is evaluated relative to the following learning objectives.

Graduates of the Human-Computer Interaction and User Experience graduate major in the Master of Science in Information (MSI) degree program will be able to:

- Solve problems in applied domains through the development of artifacts, processes, and systems
- Select, use, adapt, and explain appropriate research, design, and evaluation techniques for a range of user experience projects, populations, cultures, and application contexts
- Extend existing user experience design and evaluation techniques, and invent novel approaches to accommodate new interaction paradigms and non-standard contexts
- Build user interface prototypes using a variety of tools at different levels of complexity and fidelity

- Analyze cognitive, social, and technological components of complex systems to understand opportunities, risks, and constraints for systems and interface design

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Information Science

Major: Information Science
Degree Awarded: Doctor of Philosophy (PhD)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 11.0401
Standard Occupational Classification (SOC) code: 11-3021

About the Program

The College of Computing & Informatics' on-campus PhD in Information Science program prepares students to become creative, interdisciplinary researchers with foundations in information science, data science, and human-centered computing.

Purpose and Scope

The program is designed to support all students in attaining a high level of scholarly achievement in seminars as well as supervised and independent study. The doctoral program has two major goals: acquisition of in-depth knowledge in a specialized research area, and interdisciplinary breadth to support creative scholarship. The degree prepares students for leadership and research careers in academia, industry, administration, and policy setting.

Opportunities

Most graduates move into academic or research and development (R&D) careers.

Additional Information

A master's degree is not a prerequisite for the PhD. For more information about this program, please visit the College of Computing & Informatics PhD in Information Science webpage (https://drexel.edu/cci/academics/doctoral-programs/phd-information-science/).

Degree Requirements

Required General Course		
INFO 800	Science of Science	3.0
Required Research Methods Courses		
INFO 813	Quantitative Research Methods	3.0
INFO 816	Qualitative Research Methods	3.0
Required Foundation Courses		**6.0**
Complete 2 of the following:		
INFO 821	Foundations in Information Science	
INFO 823	Foundations in Human-Centered Computing	
INFO 825	Foundations in Data Science	
Specialization Courses *		**9.0**
Information Science		
INFO 517	Principles of Cybersecurity	
INFO 624	Information Retrieval Systems	
INFO 648	Healthcare Informatics	
INFO 662	Metadata and Resource Description	
INFO 725	Information Policy and Ethics	
INFO 732	Healthcare Informatics: Planning & Evaluation	
INFO 750	Archival Access Systems	
INFO 756	Digital Preservation	
INFO 812	Research Statistics I	
Human-Centered Computing		
CS 530	Developing User Interfaces	

CS 630	Cognitive Systems	
INFO 608	Human-Computer Interaction	
INFO 616	Social and Collaborative Computing	
INFO 690	Understanding Users: User Experience Research Methods	
INFO 691	Prototyping the User Experience	
INFO 693	Human–Artificial Intelligence Interaction	
Data Science		
CS 521	Data Structures and Algorithms I	
CS 613	Machine Learning	
CS 615	Deep Learning	
CS 660	Data Analysis at Scale	
INFO 607	Applied Database Technologies	
INFO 612	Knowledge-based Systems	
INFO 623	Social Network Analytics	
INFO 629	Applied Artificial Intelligence	
INFO 633	Information Visualization	
INFO 634	Data Mining	
INFO 692	Explainable Artificial Intelligence	
Seminars		
INFO 871	PhD Process and Practice	1.0
INFO 873	Special Topics Seminar	2.0-3.0
Research		**18.0-108.0**
INFO I999	Independent Study in INFO	
INFO 998	Ph.D. Dissertation	
Total Credits		**45.0-136.0**

* Students should select three specialization courses from any of those listed; other courses from other academic units can also be taken with approval from the PhD program director.

Sample Plan of Study

First Year			
Fall	**Credits Winter**	**Credits Spring**	**Credits**
INFO 813	3.0 INFO 800	3.0 INFO 816	3.0
INFO 871	1.0 INFO 998*	3.0 INFO 998*	3.0
INFO 998*	2.0 Foundation Course	3.0 Specialization Course	3.0
Foundation Course	3.0		
	9	**9**	**9**
Second Year			
Fall	**Credits Winter**	**Credits**	
INFO 873	1.0 INFO 873	1.0	
INFO 998*	5.0 INFO 998*	5.0	
Specialization Course	3.0 Specialization Course	3.0	
	9	**9**	
Total Credits 45			

* Number of credits taken each quarter is variable depending on stage of the project and other credit load. May be taken for additional credits if necessary.

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Software Engineering

Major: Software Engineering
Degree Awarded: Master of Science in Software Engineering (MSSE)
Calendar Type: Quarter
Minimum Required Credits: 45.0

Co-op Option: Available for full-time, on-campus master's-level students
Classification of Instructional Programs (CIP) code: 14.0903
Standard Occupational Classification (SOC) code: 15-1132; 15-1133

About the Program

The College of Computing & Informatics' Master of Science in Software Engineering (MSSE) program was created in response to the growing importance of software in modern society and the rapid rise in demand for professional software engineers.

The MS in Software Engineering program draws on the broad strengths of the College of Computing & Informatics to provide a curriculum that encompasses behavioral, managerial, and technical aspects of software engineering. The program is appropriate for students interested in technical and managerial software work across a wide range of application domains, with the objective of transforming from developers to designers, architects, and technical leaders.

All students in the program take a core curriculum that provides a foundation spanning key software engineering topics and providing an integrative software studio experience. Students also take electives allowing them to specialize and gain in-depth knowledge according to their individual interests and career goals. The degree program culminates in a hands-on capstone experience (Software Studio) in which graduate students work for two to three quarters on an intensive team-based software project, with the goal of applying what they have learned to a real-world, ongoing project.

The program provides room for those with an insufficient computing background through completion of the Post-Baccalaureate Certificate in Computer Science (p. 41).

Admission Requirements

The Master of Science in Software Engineering accepts applicants who hold a bachelor's degree from an accredited university. Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/software-engineering/ms-in-software-engineering/) for more information on admission requirements.

Additional Information

For more information about this program, please visit the College of Computing & Informatics MS in Software Engineering webpage (https://drexel.edu/cci/academics/graduate-programs/software-engineering/ms-in-software-engineering/).

Degree Requirements

Core Courses		
SE 570	Agile Software Development Process	3.0
SE 575	Software Design	3.0
SE 576	Software Reliability and Testing	3.0
SE 577	Software Architecture	3.0
SE 627	Requirements Engineering and Management	3.0
SE 638	Software Project Management	3.0
Major Electives		**9.0**
Choose 3 courses from the following:		
CS 647	Distributed Systems Software	
SE 572	Web Services and Mobile Architectures	
SE 578	Security Engineering	
SE 610	Open Source Software Engineering	
SE 630	Software Engineering Economics	
Electives		**12.0**
Choose 4 additional courses from the following:		
Up to 2 CS/SE Independent Studies		
Additional graduate-level (500+) Computer Science, Software Engineering, Data Science, Artificial Intelligence, Information Science courses (CI, CS, CT, DSCI, INFO, SE), consulting with an advisor for appropriate options.		
Additional graduate-level computing-related courses outside of CCI, consulting with an advisor for appropriate options.		
CS Postbac Courses		
CS 501	Introduction to Programming	
CS 502	Data Structures and Algorithms	
CS 503	Systems Basics	
CS 504	Introduction to Software Design	
Capstone Courses		
SE 691	Software Studio *	6.0
Total Credits		**45.0**

* SE 691 taken 2 times for a total of 6.0 credits. Students also have the options to replace with two thesis courses

Sample Plan of Study

First Year				
Fall	**Credits Winter**	**Credits Spring**	**Credits Summer**	**Credits**
SE 570	3.0 SE 576	3.0 SE 627	3.0 SE 572	3.0
SE 575	3.0 SE 577	3.0 SE 638	3.0 Elective	3.0
	6	**6**	**6**	**6**
Second Year				
Fall	**Credits Winter**	**Credits Spring**	**Credits Summer**	**Credits**
SE 691	3.0 SE 691	3.0 SE 578	3.0 Elective	3.0
Elective	3.0 Elective	3.0 SE 610	3.0	
	6	**6**	**6**	**3**

Total Credits 45

Note: Second Year Summer is less than the 4.5-credit minimum required (considered half-time status) of graduate programs to be considered financial aid eligible. As a result, aid will not be disbursed to students this term.

Dual Degree Opportunities

Graduate students already enrolled in a master's degree program at Drexel have the opportunity, through the dual master's program, to work simultaneously on two CCI master's degrees and to receive both upon graduation. To be eligible, graduate students must be currently working on their first CCI master's degree when requesting admission to the second CCI master's degree. They must obtain approval from the graduate advisors of both programs and work out a plan of study encompassing coursework and/or research (thesis) credits for both degrees.

Some courses may be used to satisfy requirements in both degrees, reducing the total number of courses taken, according to Drexel's Dual MS Degree Policy (https://drexel.edu/provost/policies/dual-masters-degree/). The dual degree for MSSE students is only available to on-campus students. Please contact your advisor (https://drexel.edu/cci/current-students/graduate-professional-development/advising/) for more information on program requirements as some CCI master's degree combinations may require additional pre-requisites.

The dual master's student must complete the Change of Curriculum and Status form (https://drexel.edu/graduatecollege/forms-policies/forms/) and obtain approvals from both graduate advisors. Final approval is granted by the Graduate College (http://drexel.edu/graduatecollege/). The student is then registered in both majors simultaneously. Upon graduation, the student must file two Application for Degree (http://drexel.edu/drexelcentral/graduation/information/applying-for-degree/) forms.

Facilities

3675 Market Street

In March 2019, the College of Computing & Informatics relocated to 3675 Market (https://drexel.edu/cci/about/our-facilities/). For the first time in the College's history, all CCI faculty, students and professional staff are housed under one roof. Occupying two floors in the brand new uCity Square building, CCI's new home offers state-of-the-art technology in our classrooms, labs, meeting areas and collaboration spaces. 3675 Market offers Class A laboratory, office, coworking, and convening spaces. In fall 2019, the College opened a third floor which will include additional offices, classrooms, innovative research labs, and a maker space. Located at the intersection of Market Street and 37th Street, 3675 Market will act as a physical nexus, bridging academic campuses and medical centers to the east and south, the commercial corridors along Market Street and Chestnut Street, and the residential communities to the north and west.

The uCity Square building offers:

- Speculative lab/office space
- World-class facilities operated by CIC (https://cic.us/philadelphia/)
- Café/restaurant on-site
- Quorum, a two-story, 15K SF convening space and conference center
- Adjacent to future public square
- Access to Science Center's nationally renowned business acceleration and technology commercialization programs

Drexel University Libraries

Drexel University Libraries (http://www.library.drexel.edu/) is a learning enterprise, advancing the University's academic mission through serving as educators, supporting education and research, collaborating with researchers, and fostering intentional learning outside of the classroom. Drexel University Libraries engages with Drexel communities through three physical locations, including W. W. Hagerty Library, Queen Lane Library, and

the Library Learning Terrace, as well as a vibrant online presence which sees, on average, over 8,000 visits per day. In the W.W. Hagerty Library location, College of Computing & Informatics students have access to private study rooms and nearly half a million books, periodicals, DVDs, videos and University Archives. All fields of inquiry are covered, including: library and information science, computer science, software engineering, health informatics, information systems, and computing technology. Resources are available online at library.drexel.edu (http://www.library.drexel.edu/) or in-person at W. W. Hagerty Library.

The Libraries also make available laptop and desktop PC and Mac computers, printers and scanners, spaces for quiet work or group projects and designated 24/7 spaces. Librarians and library staff—including a liaison librarian for computing and informatics—are available for individual research consultations and to answer questions about materials or services.

CCI Commons

Located on the 10th floor of 3675 Market Street, the CCI Commons is an open lab and collaborative work environment for students. It features desktop computers, a wireless/laptop area, free black and white printing, and more collaborative space for its students. Students have access to 3675 Market's fully equipped conference room with 42” displays and videoconferencing capabilities. The CCI Commons provides technical support to students, faculty, and professional staff. In addition, the staff provides audio-visual support for all presentation classrooms within 3675 Market. Use of the CCI Commons is reserved for all students taking CCI courses.

The computers for general use are Microsoft Windows and Macintosh OSX machines with appropriate applications which include the Microsoft Office suite, various database management systems, modeling tools, and statistical analysis software. Library related resources may be accessed at the CCI Commons and through the W.W. Hagerty Library. The College is a member of the Rational SEED Program which provides cutting-edge software development and project management software for usage in the CCI Commons and CCI classrooms. The College is also a member of the Microsoft Academic Alliance known also as “DreamSpark” that allows students free access to a wide array of Microsoft software titles and operating systems.

The CCI Commons, student labs, and classrooms have access to networked databases, print and file resources within the College, and the Internet via the University’s network. Email accounts, Internet and BannerWeb access are available through the Office of Information Resources and Technology.

CCI Learning Center

The CCI Learning Center (CLC), located in 3675 Market Street's CCI Commons student computer lab, provides consulting and other learning resources for students taking computer science classes. The CLC is staffed by graduate and undergraduate computer science students from the College of Computing & Informatics.

The CLC and CCI Commons serve as a central hub for small group work, student meetings, and TA assistance.

Research Laboratories

The College houses multiple research labs, led by CCI faculty, in 3675 Market Street including: the Drexel Health and Risk Communication Lab, Interactive Systems for Healthcare, Socio-Technical Studies Group, Intelligent Information & Knowledge Computing Research Lab, Evidence-based Decision Making Lab, Applied Symbolic Computation Laboratory (ASYM), High Performance Computing Laboratory (SPIRAL), Drexel Research on Play (RePlay) Laboratory, Software Engineering Research Group (SERG), Social Computing Research Group, Vision and Cognition Laboratory (VisCog) and the Vision and Graphics Laboratory. For more information on these laboratories, please visit the College’s research web page (http://cci.drexel.edu/research.aspx).

Graduate Minor in Applied Data Science

About the Graduate Minor

The aim is to provide a strong foundation in this area with a focus on the application of methods for solving problems or gaining insights, offering a systematic and efficient education to Drexel graduate students interested in expanding their studies through integration of data science.

The graduate minor in Applied Data Science trains current Drexel graduate students either in an MS or a PhD program to learn a variety of foundational and applied data science topics.

Program Requirements

Required Core Courses		
DSCI 511	Data Acquisition and Pre-Processing	3.0
DSCI 521	Data Analysis and Interpretation	3.0
Elective Courses		**9.0**
Choose 3 of the following:		
CS 570	Programming Foundations	
DSCI 501	Quantitative Foundations of Data Science	
DSCI 631	Applied Machine Learning for Data Science	

DSCI 632	Applied Cloud Computing	
INFO 590	Foundations of Data and Information	
INFO 591	Data and Digital Stewardship	
INFO 623	Social Network Analytics	
INFO 624	Information Retrieval Systems	
INFO 633	Information Visualization	
INFO 659	Introduction to Data Analytics	
Total Credits		**15.0**

Additional Information

For more information about this program, visit the College of Computing & Informatics (https://drexel.edu/cci/academics/graduate-programs/data-science/graduate-minor-in-applied-data-science/)website.

Graduate Minor in Computational Data Science

About the Graduate Minor

The aim is to provide a strong foundation in this area with a focus on computational and systems issues, offering a systematic and efficient education to Drexel graduate students interested in expanding their studies through the integration of data science.

Admission Requirements

The graduate minor in Computational Data Science trains current Drexel graduate students either in an MS or a PhD program of their home departments in a variety of technical data science topics.

Program Requirements

Required Core Courses		
DSCI 511	Data Acquisition and Pre-Processing	3.0
DSCI 521	Data Analysis and Interpretation	3.0
Elective Courses		**9.0**
Choose 3 of the following:		
CS 500	Fundamentals of Databases	
CS 510	Introduction to Artificial Intelligence	
CS 583	Introduction to Computer Vision	
CS 613	Machine Learning	
CS 615	Deep Learning	
CS 660	Data Analysis at Scale	
CS 661	Responsible Data Analysis	
Total Credits		**15.0**

Additional Information

For more information about this program, please visit the College of Computing & Informatics (https://drexel.edu/cci/academics/graduate-programs/data-science/graduate-minor-in-computational-data-science/)website.

Graduate Minor in Computer Science

About the Graduate Minor

The graduate minor in Computer Science trains current Drexel graduate students either in an MS or a PhD program of their home departments (other than the Computer Science Department) to obtain fundamental computer science knowledge as well as an introduction to advanced topics in computer science that will be suitable for their own graduate studies. The aim is to provide a systematic and efficient education to Drexel graduate students interested in expanding their studies through integration of computing including, but not limited to, rigorous algorithmic thinking and effective computational implementation without any prerequisites on computer science knowledge.

Program Requirements

Required Core Courses		
CS 501	Introduction to Programming	3.0
CS 502	Data Structures and Algorithms	3.0
CS 503	Systems Basics	3.0
CS 504	Introduction to Software Design	3.0
Elective Courses		**3.0**

Complete 1 course selected from the Master of Science in Computer Science Core Requirements.		
Theory		
CS 521	Data Structures and Algorithms I (Core Candidate)	
CS 525	Theory of Computation (Core Candidate)	
Intelligent Systems		
CS 500	Fundamentals of Databases (Core Candidate)	
CS 510	Introduction to Artificial Intelligence (Core Candidate)	
Programming Systems		
CS 550	Programming Languages (Core Candidate)	
SE 575	Software Design (Core Candidate)	
Computer Systems		
CS 543	Operating Systems (Core Candidate)	
CS 544	Computer Networks (Core Candidate)	
Vision and Graphics		
CS 536	Computer Graphics (Core Candidate)	
CS 583	Introduction to Computer Vision (Core Candidate)	
Applications		
CS 530	Developing User Interfaces (Core Candidate)	
CS 540	High Performance Computing (Core Candidate)	
Total Credits		15.0

Additional Information

For more information, please visit the College of Computing & Informatics (https://drexel.edu/cci/academics/graduate-programs/computer-science/graduate-minor-in-computer-science/) website.

Graduate Minor in Healthcare Informatics

About the Graduate Minor

This graduate minor provides a basic acquaintance with health informatics principles and practices for students pursuing careers in a wide variety of health-related professions. Healthcare informatics is defined here as the ability to generate data, information, and knowledge, as well as to implement, adapt, and validate existing informatics approaches to solve healthcare problems. Healthcare informatics also concerns the management and sharing of healthcare data, the social and behavioral issues in healthcare, and the ethics, law, and socioeconomic policy. Health informaticians also lead staff education and joint problem solving to promote implementation of healthcare information systems in practice and research settings.

Admission Requirements

This minor is only for currently admitted and enrolled Drexel students in good standing. Students in the MS in Health Informatics (MSHI) program are not eligible.

Program Requirements

Required Core Course		
INFO 648	Healthcare Informatics	3.0
or INFO 733	Public Health Informatics	
Electives		
Choose 4 of the following		12.0
HMP 701	Health Care Data Analytics	
INFO 517	Principles of Cybersecurity	
INFO 623	Social Network Analytics	
INFO 659	Introduction to Data Analytics	
INFO 712	Information Assurance	
INFO 731	Managing Health Informatics Projects	
INFO 732	Healthcare Informatics: Planning & Evaluation	
IPS 584	Analysis of Performance Standards in Healthcare Quality	
NURS 532	Evaluation of Health Outcomes	
NURS 553	Data Analysis for Decision-Making in HC Management	
Total Credits		**15.0**

Additional Information

For more information about this program, visit the College of Computing & Informatics (https://drexel.edu/cci/academics/graduate-programs/health-informatics/graduate-minor-in-healthcare-informatics/) website.

Graduate Minor in Human-Computer Interaction and User Experience

About the Graduate Minor

The graduate minor in Human-Computer Interaction and User Experience offers Drexel graduate students in an MS or a PhD program the opportunity to learn a variety of foundational human-computer interaction (HCI) principles and applied user experience (UX) techniques. The program provides skills and training for students who wish to expand their understanding of human-centered design and/or apply design skills in their major area of study. The minor introduces a range of techniques for the design and evaluation of technologies that support and complement human needs and abilities in a broad range of contexts such as work, wellness, home, entertainment, and artistic expression.

Admission Requirements

Open to Drexel graduate students in an MS or a PhD program.

Additional Programs in Human-Computer Interaction and Information

For students who would like to further pursue graduate studies in the information field, CCI offers a Master of Science in Information with graduate majors in Human-Computer Interaction & User Experience (https://drexel.edu/cci/academics/graduate-programs/ms-in-information/human-computer-interaction-ux-major/) and Library & Information Science (https://drexel.edu/cci/academics/graduate-programs/library-information-science/library-science-graduate-program-major/) (ALA accredited).

Program Requirements

Required Courses		
INFO 508	Information Innovation through Design Thinking	3.0
INFO 690	Understanding Users: User Experience Research Methods	3.0
INFO 691	Prototyping the User Experience	3.0
Choose 2 of the following:		**6.0**
INFO 608	Human-Computer Interaction	
INFO 615	Designing with Data	
INFO 616	Social and Collaborative Computing	
Total Credits		**15.0**

Additional Information

For more information about this program, visit the College of Computing & Informatics (https://drexel.edu/cci/academics/graduate-programs/graduate-minor-in-human-computer-interaction-user-experience/) website.

Post-Baccalaureate Certificate in Applied Artificial Intelligence/ Machine Learning for Data Science

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 11.0199
Standard Occupational Classification (SOC) Code: 15-1111

About the Program

The Applied Artificial Intelligence/Machine Learning for Data Science certificate provides a quantitative foundation in data analysis and interpretation, machine learning, artificial intelligence, deep learning, and other related electives.

Admission Requirements

The post-baccalaureate certificate in Applied Artificial Intelligence and Machine Learning for Data Science accepts applicants who hold bachelor's degrees from an accredited university. Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/data-science/graduate-certificate-in-applied-artificial-intelligence-machine-learning-for-data-science/) for more information on admission requirements.

Additional Information

For more information about this program, visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/data-science/graduate-certificate-in-applied-artificial-intelligence-machine-learning-for-data-science/).

Program Requirements

Required Courses		
DSCI 501	Quantitative Foundations of Data Science	3.0
DSCI 521	Data Analysis and Interpretation	3.0
DSCI 631	Applied Machine Learning for Data Science	3.0
Choose 2 of the electives below		**6.0**
CS 501	Introduction to Programming	
or CS 570	Programming Foundations	
CS 502	Data Structures and Algorithms	
CS 503	Systems Basics	
CS 510	Introduction to Artificial Intelligence	
CS 613	Machine Learning	
CS 615	Deep Learning	
DSCI 591	Data Science Capstone I	
DSCI 592	Data Science Capstone II	
Total Credits		**15.0**

Sample Plan of Study

First Year			
Fall	**Credits**	**Winter**	**Credits**
DSCI 501	3.0	DSCI 631	3.0
DSCI 521	3.0	Electives	6.0
	6		**9**

Total Credits 15

Post-Baccalaureate Certificate in Applied Data Science

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate

Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
*Financial Aid Eligibility: Aid eligible**
Classification of Instructional Program (CIP) Code: 11.0104
Standard Occupational Classification (SOC) Code: 15-1132

The current plan of study for this program would only allow for federal financial aid (including Federal Direct Student Loans) for terms that are at least a minimum of 4.5 credits for graduate courses and 6.0 credits for undergraduate courses. This is based on current regulations from the U.S. Department of Education.

About the Program

The post-baccalaureate certificate provides a strong foundation in data science with a focus on the techniques and methods for data analysis and real-world problem solving. The certificate program may also count towards part of the Master of Science in Data Science (p. 21) if completed with predetermined grade requirements.

Admission Requirements

The post-baccalaureate certificate in Applied Data Science accepts applicants who hold bachelor's degrees from an accredited university and offers them an opportunity to learn a variety of foundational and applied data science topics. Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/professional-development-programs/post-baccalaureate-certificate-in-applied-data-science/) to learn more about admission requirements.

Additional Information

For more information about this program, visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/data-science/graduate-certificate-in-applied-data-science/).

Program Requirements

Required Core Courses		
DSCI 511	Data Acquisition and Pre-Processing	3.0
DSCI 521	Data Analysis and Interpretation	3.0
Elective Courses		**9.0**
Choose 3 courses from the following:		
CS 570	Programming Foundations	
DSCI 501	Quantitative Foundations of Data Science	
DSCI 631	Applied Machine Learning for Data Science	
DSCI 632	Applied Cloud Computing	
INFO 590	Foundations of Data and Information	
INFO 591	Data and Digital Stewardship	
INFO 623	Social Network Analytics	
INFO 624	Information Retrieval Systems	
INFO 633	Information Visualization	
INFO 659	Introduction to Data Analytics	
Total Credits		**15.0**

Sample Plan of Study

First Year			
Fall	**Credits Winter**	**Credits Spring**	**Credits**
CS 570	3.0 DSCI 501	3.0 Elective	3.0
DSCI 511	3.0 DSCI 521	3.0	
	6	**6**	**3**

Total Credits 15

Post Baccalaureate Certificate in Artificial Intelligence and Machine Learning

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate

Number of Credits to Completion: 12.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
*Financial Aid Eligibility: Aid eligible**
Classification of Instructional Program (CIP) Code: 11.0701
Standard Occupational Classification (SOC) Code: 15.0000

The current plan of study for this program would only allow for federal financial aid (including Federal Direct Student Loans) for terms that are at least a minimum of 4.5 credits for graduate courses and 6.0 credits for undergraduate courses. This is based on current regulations from the U.S. Department of Education.

About the Program

Post-Baccalaureate Certificate in Artificial Intelligence and Machine Learning accepts applicants who hold Bachelor degrees in Computer Science, or completed a Post-Baccalaureate Certificate in Computer Science (p. 41), and offers them opportunities to learn the fundamentals of artificial intelligence and machine learning. The aim is to provide a strong foundation in this emerging area, with a focus on mathematical foundations, algorithms, and real-world applications. The certificate program may also serve as an onramp to a Master of Science in Computer Science (https://drexel.edu/cci/academics/graduate-programs/ms-in-computer-science/), the Master of Science in Data Science (https://drexel.edu/cci/academics/graduate-programs/ms-in-data-science/), or the Master of Science in Artificial Intelligence and Machine Learning (https://drexel.edu/cci/academics/graduate-programs/ms-in-artificial-intelligence-machine-learning/) if completed with predetermined grade requirements.

Admission Requirements

Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/artificial-intelligence-machine-learning/graduate-certificate-in-artificial-intelligence-machine-learning/) to learn more about admission requirements.

Program Requirements

Required Core Courses		
CS 510	Introduction to Artificial Intelligence	3.0
CS 613	Machine Learning	3.0
Elective Courses		**6.0**
Select two courses from the following:		
CS 511	Robot Laboratory	
CS 583	Introduction to Computer Vision	
CS 610	Advanced Artificial Intelligence	
CS 611	Game Artificial Intelligence	
CS 612	Knowledge-based Agents	
CS 613	Machine Learning	
CS 615	Deep Learning	
CS 618	Algorithmic Game Theory	
CS 630	Cognitive Systems	
CS 634	Advanced Computer Vision	
CS 661	Responsible Data Analysis	
CS 770	Topics in Artificial Intelligence	
DSCI 631	Applied Machine Learning for Data Science	
DSCI 691	Natural Language Processing with Deep Learning	
INFO 629	Applied Artificial Intelligence	
Total Credits		**12.0**

Sample Plan of Study

First Year			
Fall	**Credits Winter**	**Credits Spring**	**Credits**
CS 510	3.0 CS 613	3.0 Electives	6.0
	3	**3**	**6**

Total Credits 12

Additional Information

For more information about this program, please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/professional-development-programs/post-baccalaureate-certificate-in-artificial-intelligence-machine-learning/).

Post-Baccalaureate Certificate in Big Data Analytics

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 11.0199
Standard Occupational Classification (SOC) Code: 15-1111

About the Program

The post-baccalaureate certificate in Big Data Analytics provides students with big data analytics skills, including cloud computing, distributed computing, and natural language processing, as well as the opportunity of practicing their skills in capstone projects.

Admission Requirements

The post-baccalaureate certificate in Big Data Analytics accepts applicants who hold bachelor's degrees from an accredited university. Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/data-science/graduate-certificate-in-big-data-analytics/) for more information on admission requirements.

Additional Information

For more information about this program, visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/data-science/graduate-certificate-in-big-data-analytics/).

Program Requirements

Required Courses		
CS 660	Data Analysis at Scale	3.0
DSCI 632	Applied Cloud Computing	3.0
Choose 3 of the electives below		**9.0**
CS 676	Parallel Programming	
DSCI 591	Data Science Capstone I *	
DSCI 592	Data Science Capstone II *	
DSCI 691	Natural Language Processing with Deep Learning	
INFO 633	Information Visualization	
Total Credits		**15.0**

* DSCI 591 and DSCI 592 are recommended if a student wants to pursue an MSDS.

Sample Plan of Study

First Year			
Fall		**Credits Winter**	**Credits**
DSCI 632		3.0 CS 660	3.0
Elective		3.0 Electives	6.0
		6	**9**

Total Credits 15

Post-Baccalaureate Certificate in Community-based Librarianship

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 9.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible

Classification of Instructional Program (CIP) Code: 11.0401
Standard Occupational Classification (SOC) Code: 11-3021

About the Program

The post-baccalaureate certificate program in Community-based Librarianship accepts applicants who hold a bachelor's degree. It provides an intellectual foundation and fundamental practical skills for paraprofessionals and professionals interested in user and community engagement and services, information and data services, digital technology services, and public and academic librarianship. The certificate program may also serve as an on-ramp to a Master of Science in Information Library and Information Science graduate major (https://drexel.edu/cci/academics/graduate-programs/ms-in-information/library-science-graduate-program-major/) (an ALA accredited program) if completed with acceptable grade requirements.

Tuition discounts up to 25% may be available (students must apply for discounts before academic term begins). For more information about funding options for the post-baccalaureate certificate in Community-based Librarianship program, please visit the College of Computing & Informatics Funding Opportunities (https://drexel.edu/cci/admissions/graduate-professional-development/community-based-librarianship-certificate-funding-opportunities/) (https://drexel.edu/cci/admissions/graduate-professional-development/community-based-learning-certificate-funding-opportunities/)website.

Admission Requirements

This certificate program will be open to applicants who hold a bachelor's degree in any discipline.

Program Requirements

INFO 546	Data Analytics for Community-Based Data and Service	3.0
INFO 547	Design Thinking for Digital Community Service	3.0
INFO 890	Capstone Project	3.0
Total Credits		**9.0**

Sample Plan of Study

First Year

Fall	**Credits**	**Winter**	**Credits**	**Spring**	**Credits**
INFO 546	3.0	INFO 547	3.0	INFO 890	3.0
	3		**3**		**3**

Total Credits 9

Additional Information

For more information about the post-baccalaureate certificate program in Community-based Librarianship, please visit the the College of Computing & Informatics (https://drexel.edu/cci/academics/graduate-programs/library-information-science/graduate-certificate-in-community-based-librarianship/) (https://drexel.edu/cci/academics/professional-development-programs/post-baccalaureate-certificate-in-community-based-librarianship/)website (https://drexel.edu/cci/academics/graduate-programs/library-information-science/graduate-certificate-in-community-based-librarianship/).

Post-Baccalaureate Certificate in Computational Data Science

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
*Financial Aid Eligibility: Aid eligible**
Classification of Instructional Program (CIP) Code: 11.0701
Standard Occupational Classification (SOC) Code: 11-3021

The current plan of study for this program would only allow for federal financial aid (including Federal Direct Student Loans) for terms that are at least a minimum of 4.5 credits for graduate courses and 6.0 credits for undergraduate courses. This is based on current regulations from the U.S. Department of Education.

About the Program

The aim is to provide a strong foundation in this emerging area with a focus on computational and systems issues. The certificate program may also serve as an on-ramp to a Master of Science in Computer Science (p. 13) or to a Master of Science in Data Science (p. 21) if completed with predetermined grade requirements.

Admission Requirements

Please visit the College of Computing & Informatics (https://drexel.edu/cci/academics/graduate-programs/data-science/graduate-certificate-in-computational-data-science/) website to learn more about admission requirements.

Program Requirements

Required Core Courses		
DSCI 511	Data Acquisition and Pre-Processing	3.0
DSCI 521	Data Analysis and Interpretation	3.0
Elective Courses		**9.0**
Choose 3 from the following:		
CS 500	Fundamentals of Databases	
CS 510	Introduction to Artificial Intelligence	
CS 583	Introduction to Computer Vision	
CS 613	Machine Learning	
CS 615	Deep Learning	
CS 660	Data Analysis at Scale	
CS 661	Responsible Data Analysis	
Total Credits		**15.0**

Sample Plan of Study

First Year

Fall	Credits Winter	Credits Spring	Credits
DSCI 511	3.0 Electives	6.0 Elective	3.0
DSCI 521	3.0		
	6	**6**	**3**

Total Credits 15

Additional Information

For more information about this program, please visit the College of Computing & Informatics (https://drexel.edu/cci/academics/graduate-programs/data-science/graduate-certificate-in-computational-data-science/) website.

Post-Baccalaureate Certificate in Computer Science

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 12.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 11.0701
Standard Occupational Classification (SOC) Code: 15-1131

About the Program

The post-baccalaureate certificate program in Computer Science accepts applicants who hold bachelor's degrees in areas other than computer science. The program is designed to provide an accelerated four-course introduction to computer science for those looking to transition into a programming position or a Master of Science in Artificial Intelligence and Machine Learning (p. 6), Computer Science (p. 13), or Software Engineering (p. 29).

The certificate program provides training in programming, algorithms, systems, and software design. Courses in this certificate program may be transferred to the Artificial Intelligence and Machine Learning (p. 6), Computer Science (p. 13), or Software Engineering (p. 29) master's programs as elective credits if completed with predetermined grade requirements.

The post-baccalaureate certificate program in Computer Science is also appropriate for professionals in programming positions who are lacking in formal computer science training, or those working in another field who wish to develop computing skills to apply in their field.

Admission Requirements

Please visit the College of Computing & Informatics (https://drexel.edu/cci/academics/graduate-programs/computer-science/graduate-certificate-in-computer-science/) (https://drexel.edu/cci/admissions/overview/)website to learn more about admission requirements.

Program Requirements

Core Courses		
CS 501	Introduction to Programming	3.0
CS 502	Data Structures and Algorithms	3.0
CS 503	Systems Basics	3.0
CS 504	Introduction to Software Design	3.0
Total Credits		**12.0**

Sample Plan of Study

First Year

Fall	Credits Winter	Credits Spring	Credits Summer	Credits
CS 501	3.0 CS 502	3.0 CS 503	3.0 CS 504	3.0
	3	**3**	**3**	**3**

Total Credits 12

Additional Information

For more information about this certificate program, please visit the College of Computing & Informatics (https://drexel.edu/cci/academics/graduate-programs/computer-science/graduate-certificate-in-computer-science/) (http://drexel.edu/cci/academics/programs/professional-development-programs/post-baccalaureate-certificate-in-computer-science/)website.

Post-Baccalaureate Certificate in Computing Systems Security and Privacy

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 11.0701
Standard Occupational Classification (SOC) Code: 15-1122

About the Program

This certificate provides broad technical expertise in software security, network security, and computer privacy. It includes introductory courses in security engineering and computer privacy that cover the technical fundamentals. Electives provide additional in-depth expertise in operating systems, computer networks, and cryptography, which are essential bodies of knowledge to be able to do technical work in modern computer systems security.

Admission Requirements

The certificate in Computing Systems Security and Privacy accepts applicants who hold a bachelor's degree from an accredited university. Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/computer-science/graduate-certificate-computing-systems-security-privacy/) for more information on admission requirements.

Additional Information

For more information about this program, visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/computer-science/graduate-certificate-computing-systems-security-privacy/).

Program Requirements

Required Courses		
CS 590	Privacy	3.0
CS 645	Network Security	3.0
SE 578	Security Engineering	3.0

Elective Courses (choose 2)		**6.0**
CS 523	Cryptography	
CS 543	Operating Systems	
CS 544	Computer Networks	
CS 613	Machine Learning	
Consult departmental advisor for additional electives		
Total Credits		**15.0**

Sample Plan of Study

First Year

Fall	Credits	Winter	Credits
SE 578	3.0	CS 590	3.0
Elective	3.0	CS 645	3.0
		Elective	3.0
	6		**9**

Total Credits 15

Post-Baccalaureate Certificate in Digital Transformation

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 52.0216
Standard Occupational Classification (SOC) Code: 11-9199

About the Program

The interdisciplinary post-baccalaureate certificate program in Digital Transformation, jointly offered by the LeBow College of Business and College of Computing & Informatics, prepares students to understand and work with technologies that are reshaping the way contemporary businesses operate and compete. Courses provide fundamental knowledge of the technological landscape, business applications, management, and strategic considerations.

Admission Requirements

The program is designed for students who have either a technical or business bachelor’s degree from an accredited university with relevant work experience.

Program Requirements

MGMT 602	Innovation Management	3.0
MGMT 603	Technology Strategy	3.0
MIS 642	Emerging Information Technologies in Business	3.0
MIS 643	Digital Platform Management	3.0
MIS 653	Design Thinking for Digital Innovations	3.0
Total Credits		**15.0**

Sample Plan of Study

First Year

Fall	Credits	Winter	Credits
MIS 642	3.0	MIS 643	3.0
MGMT 602	3.0	MIS 653	3.0
		MGMT 603	3.0
	6		**9**

Total Credits 15

Post-Baccalaureate Certificate in Healthcare Informatics

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 9.0
Instructional Delivery: Online
Calendar Type: Quarter
Expected Time to Completion: 1 to 3 years
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 51.2706
Standard Occupational Classification (SOC) Code: 15-1111

About the Program

This online certificate program is designed for working professionals who want to increase their knowledge of how health information technology can be deployed to improve health outcomes. Clinicians and information professionals gain a broad knowledge of contemporary health informatics and the complex social and organizational issues surrounding this major change in healthcare. Students also acquire skills in planning and evaluation.

Graduates of the program may advance their careers in health-IT-related responsibilities or explore new opportunities in this growing field. Students enrolled in any master's program in the College of Computing & Informatics may also complete the certificate in Healthcare Informatics.

Admission Requirements

Please visit the Drexel University Online website (https://online.drexel.edu/online-degrees/information-sciences-degrees/cert-hci/#admissionscriteria) to learn more about admission requirements.

Additional Information

For more information about this program, visit the Certificate in Healthcare Informatics (https://www.online.drexel.edu/online-degrees/information-sciences-degrees/cert-hci/) webpage at Drexel University Online.

Program Requirements

Required Courses		
INFO 648	Healthcare Informatics	3.0
Elective Courses		**6.0**
Choose 2 of the following:		
INFO 608	Human-Computer Interaction	
INFO 623	Social Network Analytics	
INFO 659	Introduction to Data Analytics	
INFO 731	Managing Health Informatics Projects	
INFO 732	Healthcare Informatics: Planning & Evaluation	
INFO 733	Public Health Informatics	
Total Credits		**9.0**

Post-Baccalaureate Certificate in Human-Computer Interaction and User Experience

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 12.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 30.3101
Standard Occupational Classification (SOC) Code: 15-1120

About the Program

The post-baccalaureate certificate program in Human-Computer Interaction and User Experience (HCI/UX) provides foundations and practical skills for professionals who want to design and evaluate a wide variety of user experiences and computer interfaces. The certificate program may also serve as an on-ramp to a Master of Science in Information HCI/UX major (p. 24) if completed with acceptable grade requirements.

Admission Requirements

The post-baccalaureate certificate program in Human-Computer Interaction and User Experience accepts applicants who hold a bachelor's degree from an accredited university. Please visit the College of Computing & Informatics (https://drexel.edu/cci/academics/professional-development-programs/post-baccalaureate-certificate-in-human-computer-interaction/)website to learn more about admission requirements.

Additional Information

For more information about this program, please visit the College of Computing & Informatics (https://drexel.edu/cci/academics/professional-development-programs/post-baccalaureate-certificate-in-human-computer-interaction/)website.

Program Requirements

INFO 508	Information Innovation through Design Thinking	3.0
INFO 690	Understanding Users: User Experience Research Methods	3.0
INFO 691	Prototyping the User Experience	3.0
Choose 1 of the following:		3.0
INFO 608	Human-Computer Interaction	
INFO 615	Designing with Data	
INFO 616	Social and Collaborative Computing	
Total Credits		**12.0**

Sample Plan of Study

First Year

Fall	Credits Winter	Credits Spring	Credits Summer	Credits
INFO 508	3.0 INFO 690	3.0 INFO 691	3.0 Elective course	3.0
	3	**3**	**3**	**3**

Total Credits 12

Post-Baccalaureate Certificate in Information Systems Development

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not Aid eligible
Classification of Instructional Program (CIP) Code: 52.1206
Standard Occupational Classification (SOC) Code: 25-1021

About the Program

The interdisciplinary post-baccalaureate certificate program in Information Systems Development, jointly offered by the LeBow College of Business and College of Computing & Informatics, enables students to analyze, design, and deploy information systems to meet world-class standards and align with contemporary business goals. Courses cover business agility, database management, and the latest approaches to development of information systems and application software. Courses provide both practical technical and business knowledge.

Admission Requirements

The program is designed for students who have either a technical or business bachelor's degree from an accredited university with relevant work experience.

Program Requirements

CT 630	Application Software Construction and Operation	3.0
INFO 540	Perspectives on Information Systems	3.0
INFO 605	Database Management Systems	3.0

MIS 624	Systems Analysis & Design	3.0
MIS 652	Business Agility and IT	3.0

Sample Plan of Study

First Year

Fall	Credits	Winter	Credits
INFO 540	3.0	CT 630	3.0
MIS 624	3.0	INFO 605	3.0
		MIS 652	3.0
	6		**9**

Total Credits 15

Post-Baccalaureate Certificate in Information Technology and Management

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 52.1206
Standard Occupational Classification (SOC) Code: 25-1021

About the Program

The interdisciplinary post-baccalaureate certificate program in Information Technology and Management, jointly offered by the LeBow College of Business and College of Computing & Informatics, provides a comprehensive understanding of the business applications and management of information technology. Students gain expertise in the contemporary digital environment, cloud technology, alignment of operations, risk assessment, and continuity planning.

Admission Requirements

The program is designed for students who have either a technical or business bachelor’s degree from an accredited university with relevant work experience.

Program Requirements

CT 500	Introduction to the Digital Environment	3.0
CT 600	Cloud Technology	3.0
CT 610	Disaster Recovery, Continuity Planning and Digital Risk Assessment	3.0
MIS 615	Aligning Information Technologies and Operations	3.0
MIS 625	Management of Information Technology Operations	3.0
Total Credits		**15.0**

Sample Plan of Study

First Year

Fall	Credits	Winter	Credits
CT 500	3.0	CT 600	3.0
MIS 615	3.0	CT 610	3.0
		MIS 625	3.0
	6		**9**

Total Credits 15

Post-Baccalaureate Certificate in Information Technology Strategy & Execution

Certificate Level: Graduate
Admission Requirements: Bachelor's degree

Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 52.1206
Standard Occupational Classification (SOC) Code: 25-1021

About the Program

The interdisciplinary post-baccalaureate certificate program in Information Technology Strategy & Execution, jointly offered by the LeBow College of Business and College of Computing & Informatics, is designed to train the next generation of digital strategists. Students learn to evaluate and manage technology projects, lead change, and ensure alignment between a firm's technology and business strategy.

Admission Requirements

The program is designed for students who have either a technical or business bachelor’s degree from an accredited university with relevant work experience

Program Requirements

MIS 612	Aligning Information Systems and Business Strategies	3.0
MIS 641	MIS Policy and Strategy	3.0
ORGB 602	Leading and Executing Change	3.0
SE 630	Software Engineering Economics	3.0
SE 638	Software Project Management	3.0
Total Credits		**15.0**

Sample Plan of Study

First Year

Fall	**Credits**	**Winter**	**Credits**
MIS 612	3.0	MIS 641	3.0
SE 630	3.0	ORGB 602	3.0
		SE 638	3.0
	6		**9**

Total Credits 15

Introduction to Data Science Post-Baccalaureate Certificate

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 11.0199
Standard Occupational Classification (SOC) Code: 15-1111

About the Program

The post-baccalaureate certificate in Introduction to Data Science provide the basic skills in Python programming, exploratory data analytics using R, and other relevant electives.

Admission Requirements

The post-baccalaureate certificate in Introduction to Data Science accepts applicants who hold bachelor's degrees from an accredited university. Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/data-science/graduate-certificate-introduction-to-data-science/) for more information on admission requirements.

Additional Information

For more information about this program, visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/data-science/graduate-certificate-introduction-to-data-science/).

Program Requirements

Required Courses		
CS 570	Programming Foundations	3.0
DSCI 511	Data Acquisition and Pre-Processing	3.0
INFO 659	Introduction to Data Analytics	3.0
Choose 2 of the electives below		**6.0**
CS 500	Fundamentals of Databases	
CS 590	Privacy	
INFO 605	Database Management Systems	
INFO 623	Social Network Analytics	
INFO 648	Healthcare Informatics	
INFO 712	Information Assurance	
INFO 725	Information Policy and Ethics	
Total Credits		**15.0**

Sample Plan of Study

First Year

Fall	Credits	Winter	Credits
CS 570	3.0	INFO 659	3.0
DSCI 511	3.0	Electives	6.0
	6		**9**

Total Credits 15

Post-Baccalaureate Certificate in Organizational Security

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 11.0103
Standard Occupational Classification (SOC) Code: 15-1121;15-1122

About the Program

The post-baccalaureate certificate in Organizational Security provides broad knowledge on securing the business information infrastructure, cloud security, security policy, assurance, and forensics. Courses provide both practical technical and business knowledge.

Admission Requirements

The program is designed for students who have either a technical or business bachelor’s degree from an accredited university with relevant work experience.

Additional Information

For more information about this program, visit the College of Computing & Informatics website. (https://drexel.edu/cci/academics/graduate-programs/business-information-technology/graduate-certificate-organizational-security/)

Program Requirements

CT 605	Cloud Security and Virtual Environments	3.0
CT 620	Security, Policy and Governance	3.0
INFO 517	Principles of Cybersecurity	3.0
INFO 710	Information Forensics	3.0

INFO 712	Information Assurance	3.0
Total Credits		**15.0**

Sample Plan of Study

First Year

Fall	Credits	Winter	Credits
CT 620	3.0	CT 605	3.0
INFO 517	3.0	INFO 710	3.0
		INFO 712	3.0
	6		**9**

Total Credits 15

Post-Baccalaureate Certificate in Software Architecture

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Online; Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 14.0903
Standard Occupational Classification (SOC) Code: 15-1133

About the Program

Software architecture is the primary carrier of system qualities, such as performance, reliability, modifiability, and security. Architecture helps ensure that a design approach will yield an acceptable system and holds the key to maintenance and sustainment efforts, ensures critical quality attributes, and holds every phase of a project together. An architect needs build comprehensive knowledge and skills and be prepared to fulfill extensive duties way beyond programming. This certificate equips software professionals with state-of-the-art practices for designing, analyzing, documenting, and implementing software architectures.

Admission Requirements

The certificate in Software Architecture accepts applicants who hold a bachelor's degree from an accredited university. Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/software-engineering/graduate-certificate-in-software-architecture/) for more information on admission requirements.

Additional Information

For more information about this program, visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/software-engineering/graduate-certificate-in-software-architecture/).

Program Requirements

Core Courses		
SE 575	Software Design	3.0
SE 577	Software Architecture	3.0
Core electives		**6.0**
Choose 2 from the following		
CS 500	Fundamentals of Databases	
SE 572	Web Services and Mobile Architectures	
SE 576	Software Reliability and Testing	
SE 627	Requirements Engineering and Management	
Elective		**3.0**
Choose from the following or approved by the department		
CS 647	Distributed Systems Software	
INFO 608	Human-Computer Interaction	
INFO 659	Introduction to Data Analytics	
SE 578	Security Engineering	
SE 610	Open Source Software Engineering	
SE 630	Software Engineering Economics	

SE 638	Software Project Management	
Total Credits		**15.0**

Sample Plan of Study

First Year			
Fall	**Credits**	**Winter**	**Credits**
SE 575	3.0	SE 577	3.0
Core Elective	3.0	Core Elective	3.0
		Elective	3.0
	6		**9**

Total Credits 15

Post-Baccalaureate Certificate in Software Management

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 15.0
Instructional Delivery: Campus
Calendar Type: Quarter
Expected Time to Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 14.0903
Standard Occupational Classification (SOC) Code: 11-9041

About the Program

Software management is a complex endeavor requiring an understanding of software engineering technology combined with general management skills. This certificate is designed for software engineers preparing for or already in a management role. The certificate advances capabilities including requirements engineering, communicating with stakeholders, and managing time, budget, and personnel for software engineering projects.

Admission Requirements

The certificate in Software Management accepts applicants who hold a bachelor's degree from an accredited university. Please visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/software-engineering/graduate-certificate-in-software-management/) for more information on admission requirements.

Additional Information

For more information about this program, visit the College of Computing & Informatics website (https://drexel.edu/cci/academics/graduate-programs/software-engineering/graduate-certificate-in-software-management/).

Program Requirements

Required Courses		
INFO 646	Information Systems Management	3.0
SE 627	Requirements Engineering and Management	3.0
SE 630	Software Engineering Economics	3.0
SE 638	Software Project Management	3.0
Elective Course - choose 1		**3.0**
CS 647	Distributed Systems Software	
INFO 608	Human-Computer Interaction	
INFO 659	Introduction to Data Analytics	
SE 570	Agile Software Development Process	
SE 572	Web Services and Mobile Architectures	
SE 575	Software Design	
SE 576	Software Reliability and Testing	
SE 577	Software Architecture	
SE 578	Security Engineering	
SE 610	Open Source Software Engineering	
Consult with your advisor for additional appropriate courses.		
Total Credits		**15.0**

Sample Plan of Study

First Year

Fall	Credits	Winter	Credits
SE 627	3.0	INFO 646	3.0
SE 630	3.0	SE 638	3.0
		Elective	3.0
	6		**9**

Total Credits 15

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