Master of Science

# Information Technology



**ITWS @ Rensselaer Rensselaer**

-- Version --

Fall 2022

**GUIDELINES**

In an effort to ensure all academic needs of our students are met, we are setting fourth guidelines for those students that require adjustments.

The following requests will be approved once reviewed by our Graduate Program Director, ONLY, if you meet with Linda Kramarchyk first and request said changes to ones Graduate Plan of Study *a semester* before the change.

1. F1 Visa Program Extensions: Changes to your POS must be approved a semester in advance, if a student has made unapproved changes to their POS and in their final semester requests an extension without first discussing these changes a semester in advance, the request will be denied.
2. OPT/CPT requests
	1. These requests take 3-4 weeks to process. Please be prepared. An updated approved plan of study is required to process these requests. Further, these requests go through several stages (Department, OGE and ISSS) before approval.
3. Graduate Plan of Study
* You must have an approved POS on file by the add deadline of your first semester.
* Do not make changes to your Plan of Study without first consulting Linda Kramarchyk. Changes to your Plan of Study will only be approved after any proposed changes are discussed with Linda first and then presented to the Graduate Program Director. These changes and approval take time, do not wait until the semester of to make changes.

This document will serve as guidelines moving forward from August 29, 2022 and is subject to be updated. Any updates or changes to these guidelines will be shared with all MS IT Graduate Students. These guidelines will allow us to better serve you all in a more time efficient manner and will also allow us to support the Office of Graduate Education.

**MS IT CURRIUCULUM AND PLAN OF STUDY**

Rensselaer’s Master of Science in Information Technology balances the study of management strategies and technology leadership with advanced course work in an IT Focus Track. Students complete a suite of Core and Capstone courses, and also select three to five additional courses to complete their Focus Tracks. Both a professional and research track are offered for the M.S. in IT degree.

Twelve Focus Tracks are currently available at Rensselaer’s Troy Campus: Cognitive Computing, Data Science and Analytics, Information Dominance, Web Science, Networking, Management Information Systems, Software Design and Engineering, Financial Engineering, Database and Intelligent Systems, Information Security, Information Systems Engineering and Human-Computer Interaction.

**Curriculum**

Students admitted to the M.S. in IT develop an approved plan of study that includes the following:

* Ten courses in IT (A minimum of thirty credits)
* A minimum of six courses (eighteen or more credits) at the 6000 graduate level
* Five Core courses in Information Technology (IT Core). For the research track, replace ITWS-6300 Business Issues for Engineers and Scientists core course with one of the two semester courses ITWS-6980 Master’s Project or ITWS-6990 Master’s Thesis.
* A minimum of three courses (nine credit hours or more) in a Focus track\*
* One elective approved by the advisor to add further breadth or depth to the degree
* One of: ITWS-6800 Information Technology Master’s Capstone course (Professional Track), ITWS-6980 Master’s Project (Research Track) or ITWS-6990 Master’s Thesis (Research Track)

The Core and Focus Track courses are designed to accommodate a wide range of backgrounds. If students have previously completed a basic required Core course, they then complete the next level required course to add depth in that Core area. For example, if an equivalent course to Database Systems was completed in a prior degree, the Core requirement could be satisfied by taking Data Mining or Data Science. Our goal is to bring students to the next level of IT expertise.

Focus Tracks are chosen from twelve possibilities. Focus Track courses can be substituted at the discretion of the Focus Track Advisor. Students who plan to complete the program in **Two Semesters** select one Focus Track and complete most of their Core courses in the Fall followed by the Focus Track and Capstone courses in the Spring for a total of ten courses. Students who elect the **Three Semester** option are able to complete two Focus Tracks over three terms for a total of twelve courses. The Three-Semester students will also generally complete a significant salaried co-op/internship assignment over the summer (or the summer/fall) terms.

The Financial Engineering Focus Track is completed by taking core courses in Database Design, Software Design and Engineering, HCI and Data Analytics plus five Focus Track Courses and the Capstone Course. An upper level course in Finance is a prerequisite.

The M.S. in IT Capstone course integrates the knowledge and professional practice of IT Core and Focus Track courses. Topics in database systems, networking, data analytics, software design and engineering, management of technology, human computer interaction, and ethics are applied within a framework of global e-business strategy. The course utilizes an Information Technology Team Project with a real organization to practice the major concepts of the IT Degree. Team members select, develop, and present a significant technology implementation project, incorporating strategy, systems development and business planning.

Rensselaer currently offers numerous Ph.D. degrees with significant IT related research including the

Multidisciplinary Science degree with a research track in Information Technology. There is no separate Ph.D. degree in Information Technology.

Transfer credit is not expected to fulfill Core or Focus Track requirements. Students can waive an IT core area requirement and substitute an approved elective only if they have already taken the equivalent of all listed core courses. Students may request transfer credit for the elective, subject to advisor approval. Additionally, no more than half of all credits used towards the M.S. in IT degree may be taken from courses offered by the Lally School of Management and Technology. These courses are coded MGMT.

### Core Courses

To acquire a breadth of IT experience, master’s degree students take the five Core courses listed below and one elective to add depth to the degree. If students have previously completed a Core course at Rensselaer or elsewhere, they fulfill the Core requirement by taking an advanced course in that area.

#### Required Core Courses

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| **IT Core Area**  | **Course Number**  | **Course Title**  | **Term(s) Offered**  |
| **Database Systems**  | CSCI-4380  | Database Systems\*  | Fall/Spring |
|  | ITWS-6250  | Database Applications and Systems\*  | Fall  |
| **Data Analytics**  | ITWS-6350  | Data Science  | Fall  |
| **Software Design and Engineering**  | CSCI-4440  | Software Design and Documentation  | Fall/Spring  |
| ITWS-6700  | Software Development  | Spring |
| **Management of Technology\*\*** | ITWS-6300  | Business Issues for Engineers and Scientists (Professional Track Only)  | Fall/Spring  |
| **Human Computer** **Interaction**  | COMM-6420  | Foundations of HCI Usability  | Fall  |
| **Elective**  |   | Any 4000/6000 Level course found in this document or approved by your advisor. | Fall/Spring  |

**\*** Students may receive credit for only one ITWS-4250, ITWS-6250 or CSCI-4380.

**\*\*** For the research track, replace ITWS-6300 Business Issues for Engineers and Scientists with one of the two semester courses ITWS-6980 Master’s Project or ITWS-6990 Master’s Thesis.

**\*\*** For students who have graduated with an ITWS UG degree; and students who are dual MS with Management, replace ITWS-6300 with a 4000/6000 level MGMT elective approved by your advisor.

**One of:**

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| **Master’s Capstone\***  | ITWS-6800  | Information Technology Master’s Capstone (Professional Track Only)  | Fall/Spring  |
| **Master’s Project**  | ITWS-6980  | Master’s Project (Research Track)  | Fall/Spring  |
| **Master’s Thesis**  | ITWS-6990  | Master’s Thesis (Research Track)  | Fall/Spring  |

 **\*** For the professional track, ITWS-6800 can be replaced with ITWS-6980 Master’s Project if you have already taken ITWS-4100

####  Advanced Core options for students who have previously completed a Core Course

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| **IT Core Area**  | **Course Number**  | **Course Title**  | **Term(s) Offered**  |
| **Database Systems**  | CSCI-6390  | Data Mining  | Fall  |
| ITWS-6350  | Data Science  | Fall  |
| **Data Analytics**  | CSCI-6390  | Data Mining  | Fall  |
| ITWS-6400  | X-Informatics  | Spring  |
| ITWS-6600  | Data Analytics  | Fall/Spring  |
| **Software Design and Engineering**  | CSCI-6500  | Distributed Computing Over the Internet  | Spring  |
| ITWS-6400  | X-Informatics  | Spring  |
| **Management of Technology**  | MGMT-6080  | Networks and Value Creation  | Fall  |
| MGMT-6140  | Managing Digitization and Transformation  | Spring  |
| **Human Computer** **Interaction** | HCDE-6340  | User Experience Design | Fall |
|  | COMM-6880  | Interactive Data Visualization  | Summer  |

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### Focus Tracks

The ITWS faculty designed the IT Focus Tracks to provide an in-depth, leading-edge experience in the application of information technology. Students often select areas that complement their prior backgrounds (e.g., students with strong backgrounds in computer science may select MIS or Information Systems Engineering). Alternately, some students select a Focus Track area related to their prior backgrounds and then expand on that background through higher-level coursework.

**NOTES:**

* Courses taken to complete a Core requirement do not count towards the Focus Track.
* Students must have the prerequisites knowledge for each course as described in the university catalog: <http://www.rpi.edu/academics/catalog/index.html>

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **COGNITIVE** **COMPUTING** ADVISOR: BRAM VAN HEUVELN  | Different people take ‘cognitive computing’ to mean different things. Roughly, we can split these different meanings in two groups. The first group uses ‘cognitive computing’ to denote computational methods that attempt to mimic the way the human mind processes information: stand-alone technologies that have cognitive capacities in and of themselves. An example would be a deep learning neural network that performs image recognition. The second group uses the term to denote computational tools that ‘fit’ and ‘enhance’ the human mind: human-centered technologies that are cognitively ergonomic and cognitively enabling: technologies that take into account the scope and limits of human cognition but that allow the human user to augment their cognitive capacities. An example would be Watson as a paramedic. Of course, these two different meanings are not exclusive. In fact, in order for a system to augment the cognitive powers of a human user, the system is likely to require some intelligence in and of itself. Our program of Cognitive Computing is along the lines of the second meaning of the term: it is a program that studies how human cognition can be extended through the use of intelligent technology. As such, the program draws largely from the cognitive sciences, information sciences, and communication sciences.  |
| **Select three of the following courses:**  |
| COGS-6210  | Cognitive Modeling I  | Spring  |
| CSCI-4100  | Machine Learning from Data  | Fall  |
| CSCI-6270  | Computational Vision  | Fall  |
| CSCI-6390  | Data Mining  | Fall  |
| COGS-6410  | Programming for Cog Sci and AI  | Spring  |
| ITWS-6400  | X-informatics  | Spring  |
| ISYE-4260  | Human Performance Modeling and Support  | Availability of instructor |
| PSYC-4370  | Cognitive Psychology  | Fall/Spring |

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **DATA** **SCIENCE AND** **ANALYTICS** ADVISOR: THILANKAMUNASINGHE  | Data and Information analytics extends analysis (descriptive and predictive models to obtain knowledge from data) by using insight from analyses to recommend action or to guide and communicate decision-making. Thus, analytics is not so much concerned with individual analyses or analysis steps, but with an entire methodology. Key topics include: advanced statistical computing theory, multivariate analysis, and application of computer science courses such as data mining and machine learning and change detection by uncovering unexpected patterns in data.  |
| **Select two or three of the following courses:**  |
| ITWS-6350  | Data Science  | Fall  |
| ITWS-6400  | X-Informatics  | Spring  |
| ITWS-6600  | Data Analytics  | Fall/Spring  |
| **If only two of the above were chosen, select one more of the following courses:**  |
| COMM-6880  | Interactive Data Visualization  | Summer  |
| CSCI-4020  | Design and Analysis of Algorithms  | Spring  |
| CSCI-4150  | Introduction to AI  | Spring |
| CSCI-4220  | Network Programming  | Fall  |
| CSCI-4320/CSCI-6360  | Parallel Programming/ Parallel Computing  | Spring  |
| CSCI-6100  | Machine Learning from Data  | Fall  |
| CSCI-6020  | Design and Analysis of Algorithms  | Spring  |
| CSCI-6270  | Computational Vision  | Fall  |
| CSCI-6390  | Data Mining  | Fall  |
| ISYE-4140 | Statistical Analysis | Spring/ Summer |
| ISYE-4220  | Optimization Algorithms and Applications  | Availability of instructor  |
| ISYE-4360 | Applied Data Science | Availability of instructor |
| ISYE-6350 | Systems Engineering and Social Media | Availability of instructor |
| ITWS-6360  | Data and Society  | Spring  |
| ITWS-6440  | Big Data Policies  | Spring  |
| MGMT-6100 | Foundations of Data Science | Fall/Spring |
| MGMT-6560  | Intro to Machine Learning Aps  | Fall/Spring  |

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **DATABASE** **AND** **INTELLIGENT** **SYSTEMS** ADVISOR: RICHARD PLOTKA  | The Database and Intelligent Systems Focus Track prepares students for careers in database design, database administration, database application development, or database systems implementation. Database design focuses on modeling some aspect of a physical or conceptual world that must be captured in a database as part of a larger application system. Database administration (DBA) focuses on installation, operation, and maintenance of a database system and its applications on a day-by-day basis for an organization or company. Database application development focuses on building complex application systems, including web-based applications that use a database at their core. Database systems implementation focuses on creating the underlying database system itself and is most likely done with a career in a database vendor company.  |
| **Select three of the following courses:**  |
| CSCI-4150  | Introduction to AI  | Spring  |
| CSCI-6100  | Machine Learning from Data  | Fall  |
| CSCI-6390  | Data Mining  | Fall  |
| CSCI-6510  | Distributed Systems and Algorithms  | Fall  |
| ISYE-4810  | Computational Intelligence  | Upon availability of instructor  |
| ITWS-6350  | Data Science  | Fall  |
| ITWS-6600  | Data Analytics  | Fall/Spring  |

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **FINANCIAL** **ENGINEERING\*** **\* prerequisite – knowledge in** **finance is required** ADVISOR: APARNA GUPTA   | The Financial Engineering Focus Track prepares students for careers in the financial industry, with opportunities in financial analysis, management, and consulting and also in banking, investments, and insurance. The combination of advanced study in IT and Financial Engineering uniquely qualifies graduates to assist firms seeking IT solutions to financial systems. The FE Focus Track is offered jointly with the Lally School of Management and Technology. Students are introduced to the mathematical approach to risk analysis, portfolio selection, investment planning and derivative instruments, among other financial topics. Focus will be on modeling, optimization, statistical and other computational techniques.  |
| MATH-4740   | Intro. To Financial Mathematics and Engineering (required)  | Fall term even numbered years  |
| MGMT-7760  | Risk Management (required)  | Spring  |
| **With Advisor approval, choose three additional courses:**  |
| CSCI-4120/6120  | Computational Finance | Upon availability of instructor |
| ECON-4120  | Mathematical Methods in Economics  | Fall  |
| MATP-4700  | Mathematical Models of Operations Research  | Fall  |
| MATP-4820  | Computational Optimization  | Spring  |
| MGMT-6020  | Financial Management I  | Spring  |
| MGMT-6370  | Options, Futures and Derivatives Markets  | Fall  |
| MGMT-6400  | Financial Econometrics Modeling  | Spring  |
| MGMT-6420  | Student Managed Investment Fund | Spring |
| MGMT-6510  | Financial Computation & Simulation | Spring |
| MGMT-6520  | Financial Modeling and Optimization | Fall |

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **HUMAN COMPUTER** **INTERACTION** ADVISOR: PATRICIA SEARCH  | The Human-Computer Interaction Focus Track prepares IT professionals for careers in information technology design and development. The focus is on the ways technical skills in IT can be applied in a user-centered rather than a strictly technology-centered or developer-centered way. In the HCI Focus Track, students are given the opportunity to: * practice the research and design skills necessary to produce effective, usable human interfaces for IT systems
* deepen their understanding of cognitive and social theories underlying effective human interface design, and
* acquire the ability to make strategic decisions based on user data which will enhance the processes and products associated with IT design

Students with an HCI Focus Track may go on to careers in fields such as User-Centered Design, Human Factors and Usability Engineering, and Quality Assurance, contributing to a wide variety of hardware and software product areas.  |
| **Select three of the following courses:**  |
| COMM-4470  | Information Design  | Spring  |
| COMM-4690  | Interface Design: Hypermedia and Application  | Spring term, even numbered years  |
| ARTS-6090  | Art and Code and Interactivity  | Fall  |
| COMM-6560  | Visual Design: Theory and Application  | Fall term – even numbered years |
| COMM-4880/6880  | Interactive Data Visualization  | Summer  |
| HCDE-6330 | Information Design | Spring |
| HCDE-6340 | User Experience Design | Fall |
| ISYE-4260  | Human Performance Modeling and Support  | Upon availability of instructor  |

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **INFORMATION** **DOMINANCE** ADVISOR: BRIAN CALLAHAN  | The Information Dominance Focus Track prepares students for careers designing, building, and managing secure information systems and networks. The Focus Track includes advanced study in encryption and network security, formal models and policies for access control in databases and application systems, secure coding techniques, and other related information assurance topics. The combination of coursework provides comprehensive coverage of issues and solutions for utilizing high assurance systems for tactical decision-making. It prepares students for careers ranging from secure information systems analyst, to information security engineer, to field information manager and chief information officer. It is also appropriate for all IT professionals who want to enhance their knowledge of how to use pervasive information in situational awareness, operations scenarios, and decision-making.  |
| **Select two or three of the following courses:**  |
| CSCI-4220  | Network Programming  | Fall  |
| CSCI-6230  | Cryptography and Network Security I  | Fall  |
| ECSE-4670  | Computer Communication Networks  | Fall  |
| ISYE-4310  | Ethics of Modeling for Industrial Systems Engineering  | Upon availability of instructor  |
| ITWS-4370  | Information System Security  | Spring  |
| ITWS-6600  | Data Analytics  | Fall/Spring  |
| **If only two of the above were chosen, select one more of the following courses:**  |
| CSCI-6390  | Data Mining  | Fall  |
| ITWS-496X  | Modern Binary Exploitation  | Fall  |
| ITWS-6440  | Big Data Policies  | Spring  |
| CSCI-6450  | Principles of Program Analysis  | Spring term – even numbered years  |

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **INFORMATION** **SECURITY** ADVISOR: BRIAN CALLAHAN | The Information Security Focus Track prepares students for careers designing, building, and managing secure computer systems and networks. The Focus Track includes advanced study in encryption and network security, formal models and policies for access control in databases and application systems, secure coding techniques, and other related information assurance topics. The combination of coursework provides comprehensive coverage of issues and solutions for building and operating high assurance systems. It prepares students for careers ranging from secure systems analyst, to security engineer, to security manager and chief security officer. It is also appropriate for other IT professionals who want to enhance their knowledge of information assurance.  |
| **Select two or three of the following courses:**  |
| CSCI-4210  | Operating Systems  | Spring/Summer  |
| CSCI-6230  | Cryptography and Network Security I  | Fall  |
| ITWS-4370  | Information System Security  | Spring  |
| **If only two of the above were chosen, select one more of the following courses:**  |
| ITWS-496X  | Modern Binary Exploitation  | Fall  |
| CSCI-6390  | Data Mining  | Fall  |
| ISYE-4310  | Ethics of Modeling for Industrial Systems Engineering  | Upon availability of instructor  |

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **INFORMATION SYSTEMS** **ENGINEERING** ADVISOR: AL WALLACE  | The Information Systems Engineering (ISE) Focus Track prepares students to succeed in the Information Systems (IS) profession as a technically competent systems analyst, software designer, and application developer. The IS profession is generally made up of business analysts, systems designers, and programmers; where business analysts identify requirements with end users, systems designers construct the information architecture (networks, databases, and applications) required, and programmers develop the software implementation. Graduates of this ISE Focus Track will claim the middle domain, systems designer, while being perfectly capable of moving into either of the other two domains. The graduates could go anywhere information systems are used, meaning essentially any modern organizations in any sector of the economy. The ISE curriculum combines competencies in databases and software engineering with technical analysis and design tools to give graduates a unique blending of knowledge.  |
| **Select three of the following courses:**  |
| CSCI-6390  | Data Mining  | Fall  |
| CSCI-6120  | Computational Finance  | Upon availability of instructor  |
| ECSE-6860  | Evaluation Methods for Decision Making  | Upon availability of instructor |
| ISYE-4310  | Ethics of Modeling for ISYE  | Upon availability of instructor |
| ISYE-6610  | Systems Modeling in Decision Sciences  | Fall  |
| ISYE-6620  | Discrete-Event Simulation  | Spring  |
| ITWS-6600  | Data Analytics  | Fall/Spring  |
| MGMT-6140  | Managing Digitization and Transformation  | Spring  |
| MGMT-6170  | Advanced Systems Analysis and Design  | Spring  |
| MGMT-6570  | Advanced Data Resource Management  | Fall/Spring  |

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **MANAGEMENT** **INFORMATION** **SYSTEMS** ADVISOR: MATTHEW GRILL   | The Management Information Systems Focus Track is designed for professionals seeking executive positions with responsibilities for achieving competitive advantage through the effective development and integration of information technology into organizations. The emergence of Internet and the World Wide Web has ushered in a new paradigm for organizing in which information technology and IT management capabilities could determine winners and losers in electronic markets. The net result is a growing need for managers in all functional areas to be conversant with strategies and tactics for managing the use of information technology. This Focus Track is designed to fulfill this need and expose students to IT management concepts and theories. The courses use an interdisciplinary approach, are project and case based and provide a solid grounding in systems analysis and design, IT project management, enterprise information architecture planning and design, evaluation of IT value, identification and assessment of opportunities for IT-enabled business transformation and information systems management. MIS graduates can find managerial positions in the information systems departments in organizations and in consulting.  |
| **Select three of the following courses**  |
| **Note: A maximum of five management courses (prefix: MGMT) may be taken towards the IT degree.**  |
| CSCI-6390  | Data Mining  | Fall  |
| MGMT-4150  | IT Project Management  | Spring  |
| MGMT-6060  | Business Implications of Emerging Technologies  | Fall  |
| MGMT-6080  | Networks and Value Creation  | Fall  |
| MGMT-6140  | Managing, Digitization and Transformation  | Spring  |
| MGMT-6560  | Intro to Machine Learning Apps  | Fall/Spring  |
| MGMT-6570  | Advanced Data Resource Management  | Fall/Spring |
| MGMT-6690 | Negotiations | Spring |
|  | MGMT-6720  | Internet Marketing  | Spring  |

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **NETWORKING** ADVISOR: CHRIS CAROTHERS  | The Computer Networking Focus Track prepares students for careers in network design and planning, network monitoring and management, network application development, or network deployment and customization. Network design and planning focuses on projecting the organization or company needs onto the structure and configuration of its network, including capacity, security and applications. Network monitoring and management focuses on installation, operation, and maintenance of a network, including identifying and responding to the failures and attacks, on a day-by-day basis for an organization or company. Network application development focuses on building complex distributed software systems that depend heavily in their execution on networking. Network deployment and customization focuses on creating the network for a company or organization, including customization of the general network features. Typical careers will place graduates at network vendor companies, Internet service or application providers (ISP or ASP) or at the IT departments of any organization or enterprise.  |
| **Select three of the following courses:**  |
| CSCI-4220  | Network Programming  | Fall  |
| CSCI-4320/ CSCI-6360  | Parallel Programming/ Parallel Computing  | Spring  |
| CSCI-6230  | Cryptography and Network Security I  | Fall  |
| CSCI-6250  | Frontiers of Network Science  | Fall term, odd numbered years |
| CSCI-6510  | Distributed Systems and Algorithms  | Fall  |
| ECSE-4670  | Computer Communication Networks  | Fall  |

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **SOFTWARE** **DESIGN AND** **ENGINEERING** ADVISOR: RICHARD PLOTKA  | The Software Design Focus Track prepares students for careers in design and development of software applications and infrastructure. For software applications design and development, students obtain necessary skills and perspective for supervising and participating in all phases of software projects: architecture, high-level design, detailed design, documentation, implementation, testing, systems integration, and system maintenance. These same phases are also important in developing software infrastructure, including software component libraries and other foundations for productive applications development. Additional issues for software infrastructure include systematic classification of software library components, design of interfaces for interoperability, and assuring reliability and high performance even as existing components are redesigned for broader applicability. Areas in which there is high demand for software applications designers include, among many others, simulation software, distributed systems, embedded systems, web technologies and protocols, and graphical user interfaces. Companies and organizations developing such applications are also increasingly recognizing the role of specialists in software infrastructure.  |
| **Select two or three of the following courses:**  |
| CSCI-4210  | Operating Systems  | Spring/Summer |
| CSCI-4320/ CSCI-6360  | Parallel Programming/ Parallel Computing  | Spring  |
| CSCI-4430  | Programming Languages  | Fall  |
| CSCI-4440  | Software Design and Documentation  | Fall/Spring  |
| CSCI-6510  | Distributed Systems and Algorithms  | Fall  |
| ISYE-4220  | Optimization Algorithms and Applications  | Upon availability of instructor |
| ITWS-6400  | X-Informatics  | Spring  |
| ITWS-6700  | Software Development  | Spring  |
| MGMT-6170  | Advanced Systems Analysis and Design  | Spring  |
| **If only two of the above were chosen, select one more of the following courses:**  |
| COMM-4690  | Interface Design: Hypermedia Theory and Application  | Spring term – even numbered years |
| COMM-6560  | Visual Design: Theory and Application  | Fall  |
| COMM-6880  | Interactive Data Visualization  | Summer  |

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| **Concentration**  | **Course Number**  | **Course Name**  | **Term(s) Offered**  |
| **WEB SCIENCE** ADVISOR: JIM HENDLER  | The study of Web Science gives students insights into understanding what the web is and how to engineer its future and ensure its social benefit. The new Web Science Focus Track contains courses focused on one of the most powerful research, social and commercial technologies of our time.  The leader of the Focus Track is Dr. James Hendler, an internationally renowned figure in Web research and one of the pioneers of the Semantic Web. Along with colleagues Dr. Peter Fox and Dr. Deborah McGuinness, Dr. Hendler is working on research to advance scientific discovery and innovation by enabling rapid and easy collaboration between scientists, educators, students, policy makers, and even “citizen scientists” around the world wide web. They have created an innovative set of courses that focus on new trends in eScience and new technologies for the World Wide Web.  IT professionals who complete this Focus Track can apply their knowledge to careers in web-based businesses, web-based startup companies, or to playing the role of innovators in their organizations’ use of the web.  |
| **Select two or three of the following courses:**  |
| COMM-4470  | Information Design  | Fall  |
| COMM-4580  | Advertising and Culture  | Spring term – even numbered years |
| COMM-4690  | Interface Design: Hypermedia Theory and Application  | Spring term – even numbered years  |
| COMM-6510  | Communication Theory & Practice | Fall  |
| COMM-6880  | Interactive Data Visualization  | Summer  |
| CSCI-4220  | Network Programming  | Fall  |
| CSCI-6510  | Distributed Systems and Algorithms  | Fall  |
| ITWS-6400  | X-Informatics  | Spring  |
| MGMT-6720  | Internet Marketing  | Spring  |
| **If only two of the above were chosen, select one more of the following courses:**  |
| CSCI-6100  | Machine Learning from Data  | Fall  |
| CSCI-6340 | Ontologies  | Fall  |
| ITWS-6350  | Data Science  | Fall  |
| ITWS-6600  | Data Analytics  | Fall/Spring  |

**Admissions Requirements**

Applicants are expected to have prior academic records that indicate their ability to excel in advanced coursework. Prospective students should also have completed the equivalent to the following three Rensselaer courses prior to enrollment:

* CSCI-1100 Computer Science I (Fundamentals of Computer Science) – Number systems; basic computer architecture; stepwise refinement of algorithms; functions and parameter passing; basic programming concepts through two-dimensional arrays and pointer basics using C++.

* CSCI-1200 Data Structures – Pointers; classes; operator overloading; deep vs. shallow copy constructors; inheritance; file I/O; templates in C++, introductory algorithm analysis and data structures.

* CSCI-2300 Introduction to Algorithms – Topics including mathematical induction and its application to algorithm design; linear structures; trees and balanced trees; heaps and priority queues; graphs and graph algorithms; backtracking, divide-and-conquer and greedy algorithms.

**For Additional Information:**

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