Bachelor of Science
in
Information Technology
and Web Science

Curriculum
and
Concentrations

-- Version --
Fall 2015

Rensselaer Polytechnic Institute

Table of Contents

Overview

In the ITWS degree we are combining Information Technology and Web Science so that we are understanding the interplay between the social, scientific and technical issues underlying the WWW and other information technologies. ITWS combines technical courses and courses in human computer interaction, the social implications of IT, communications, management, leadership, team building and now we are highlighting courses in web science. Students also select a concentration, of which 8 courses are in a selected field. So they graduate with a foundation in IT/Web Science and an area of expertise to apply the technology. Students receive a broad yet focused degree and are prepared to apply the technology to their given field and understand the impact it has on society.

Web Science models how the Web is structured. It helps us engineer a better Web. The Web needs to be understood and it needs to be engineered. Web science offers the prospect of creating more powerful ways to define, link and interpret data.
Some of the issues being addressed in Web Science:

Design Principles – new science will model the web structure.

Online human interactions – a small technical innovation can launch a large social phenomenon.

Laws relating to intellectual property. Web Science can provide ways to check information, while offering rules and conditions about reuse of material.

Trust of material – provide users a better way of determining if material on a site can be trusted.

The program consists of 128-130 credit hours, of which 36-38 credit hours constitute an ITWS Core, 32 credit hours constitute a concentration, and the remaining credit hours fulfill Rensselaer degree requirements. The ITWS Core requirements establish a solid foundation for the application of ITWS to any discipline. The Rensselaer requirements ensure the breadth of the degree and that it is consistent with the long established tradition of a Rensselaer degree. The required concentration provides an opportunity for in depth study of an ITWS application area. Available concentrations are listed in the Table of Contents. With faculty advisement, students may also select their own courses to fulfill concentration requirements and explore their own interests. It is expected that new concentrations will be created as new ITWS application areas are identified and developed. For the most recent list of available concentrations, see the ITWS home page (http://itws.rpi.edu/).

Both a professional and research track are offered for the BS in ITWS degree. For the research track, the capstone course is replaced with a two-semester thesis.

Students must satisfy an 8-credit communication requirement. See your advisor for details.

If a student chooses to pursue a dual degree with Information Technology and Web Science as one of the degrees, the dual degree must be the degree that is closest to the concentration. For example, if a student's concentration is Psychology then the dual degree would need to be in Psychology.

Degree Requirements

The requirements for the Bachelor of Science in Information Technology and Web Science degree are shown below. Only Free Electives and HASS Electives may be taken with the Pass/No Credit option.

ITWS Core Requirements: (36 - 40 credits)		
	1. ITWS-1100 Introduction to Information Technology and Web Science	4 credits
	2. Select one of the four Technical Tracks based on Concentration (see table on page 8)	12 credits
	3. ITWS-2110 Web Systems Development	4 credits
	4. ITWS Elective (one of): CSCI-4380 Database Systems MGMT-4170 Data Resource Management	4 credits
	5. One of:[1] ITWS-4100 Information Technology and Web Science Capstone (Professional Track) ITWS-4990 Senior Thesis (Research Track – Two Semesters)	4 credits 6 credits
	6. ITWS-4500 Web Science Systems Development	4 credits
	7. ITWS-4310 Managing IT Resources	4 credits

Math/Science Requirements: (24 credits)		
	1. MATH-1010 Calculus I	4 credits
	2. Math Elective	4 credits
	3. CSCI-1100 Computer Science I	4 credits
	4. CSCI-1200 Data Structures	4 credits
	5. Physical Science Elective (PHYS-XXXX)	4 credits
	6. Life Science Elective (BIOL-XXXX)	4 credits

Humanities, Arts and Social Sciences Requirements: (24 credits)		
	1. ITWS-1220 IT and Society	4 credits
	2. ITWS-2210 Intro to Human Computer Interaction	4 credits
	3. Humanities Elective	4 credits
	4. Social Science Elective	4 credits
	5. HASS Elective	4 credits
	6. HASS Elective	4 credits

Free Elective Requirements: (8-12 credits)		
	1. Free Elective	4 credits
	2. Free Elective	4 credits
	3. Free Elective	4 credits

Student-Selected Concentration: (32 credits)		
	1. Concentration Course	4 credits
	2. Concentration Course	4 credits
	3. Concentration Course	4 credits
	4. Concentration Course	4 credits
	5. Concentration Course	4 credits
	6. Concentration Course	4 credits
	7. Concentration Elective	4 credits
	8. Concentration Capstone/Course	4 credits

The student selects a concentration from a list of available concentrations later in this document. Each concentration prescribes the courses that it requires. Alternatively, a student may choose his or her own courses with faculty advisement to fulfill concentration requirements and explore a special interest.

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Technical Tracks

(Select technical track based on concentration)

	Technical Track Courses	Concentrations
Computer Engineering Track	1) ECSE-2610 Computer Components and Operations 2) ENGR-2350 Embedded Control 3) ECSE-2660 Computer Architecture, Networking and Operating Systems	Civil Engineering Computer Hardware Computer Networking (hardware focus) Mechanical/Aeronautical Engineering
Computer Science Track	1) CSCI-2200 Foundations of Computer Science 2) CSCI-2300 Introduction to Algorithms 3) CSCI-2500 Computer Organization	Cognitive Science Computer Networking (software focus) Information Security Machine and Computational Learning
Information Systems Track	1) CSCI-2200 Foundation of Computer Science 2) CSCI-2500 Computer Organization 3) Four credits from the following: • CSCI-2220 Programming in Java (2 credits) • CSCI-2961 Program in Python (2 credits) • CSCI-2300 Introduction to Algorithms (4 credits)	Arts Communication Economics Entrepreneurship Finance Management Information Systems Medicine Pre-law Psychology STS
Web Science Track	1) CSCI-2200 Foundations of Computer Science 2) CSCI-2500 Computer Organization 3) Web/Data Course approved by ITWS Curriculum Committee	Data Science Science Informatics Web Technologies

HASS Requirements

All students working toward a B.S. degree are required to take a selection of Humanities, Arts, and Social Science courses that is referred to as the HASS core. It consists of 24 credit hours or six courses distributed in such a way as to afford students a breadth of perspective across the various disciplines as well as a more in-depth experience in at least one area. Distribution Requirements - To ensure that students have breadth in their core courses, students must select at least two courses (8 credit hours) from humanities and two courses (8 credit hours) of social sciences. HASS interdisciplinary courses (IHSS) may be substituted for courses in either category. To ensure that students have some depth in their HASS core, students must take at least two courses within a single area prefix (STSH and STSS can be counted as a single area), at least one of which is taken at an advanced level (above 1000). No course within the depth sequence may be taken as Pass/No Credit. No more than three 1000-level HASS courses may be applied toward the HASS core requirement, no more than 6 credits may be taken as Pass/No credit and at least one course (4 credits) must be at the 4000 level.

NOTE: For ITWS students ITWS-1220 IT and Society (Social Science) and ITWS-2210 Intro to Human Computer Interaction (Humanities) are counted towards your HASS requirements. No other ITWS core courses or concentration courses can be counted towards your HASS core requirements.

Suggested 2000/4000 HASS Courses for ITWS Students

ARTS-2540 The Multimedia Century
COMM-4180 Studio Design in HCI
COMM-4400 Cross-Cultural Media: Analysis and Application
COMM-4470 Information Design
COMM-4560 Media and Popular Culture
COMM-4710 Communication Design for the WWW
COMM-4770 User-Centered Design
ECON-4110 Economic Analysis of Technological Change
ECON-4140 Structure of Industry: Competition, Innovation, Entrepreneurship, Policy
ECON-4230 Environmental Economics
PSYC-2220 Human Factors in Design
STSH-4210 Engineering Ethics
STSH-4510 History of American Technology
STSS-2210 Design, Culture and Society
STSS-4350 Politics of Design

Sample Layout of Courses

The requirements for the Bachelor of Science in Information Technology and Web Science can be organized into an eight-semester program, with four courses each semester, as shown below. This layout of the courses is intended only as a suggestion. Other arrangements of the courses are possible.

Fall	Spring
Semester I ITWS-1100 Introduction to Information Technology and Web Science Concentration Course CSCI-1100 Computer Science I MATH-1010 Calculus I	**Semester II** ITWS-1220 IT and Society CSCI-1200 Data Structures Math Elective Physical Science Elective (PHYS-XXXX)
Semester III ITWS-2110 Web Systems Development Technical Track Course #1 (see chart on page 8) Concentration Course HASS Elective[1]	**Semester IV** ITWS-2210 Intro to Human Computer Interaction ITWS-4500 Web Science Systems Development Technical Track Course #2 (see chart on page 8) HASS Elective[1]
Semester V ITWS-4310 Managing IT Resources Technical Track Course #3 (see chart on page 8) Life Science Elective (BIOL-XXXX) Concentration Course	**Semester VI** ITWS Elective (one of): - CSCI-4380 Database Systems - MGMT-4170 Data Resource Management Concentration Course Concentration Course Free Elective
Semester VII One of:[2] - ITWS-4100 Information Technology and Web Science Capstone (Professional Track) - ITWS-4990 Senior Thesis (Research Track) Concentration Course HASS Elective[1] Free Elective	**Semester VIII** Concentration Capstone/Course Concentration Course HASS Elective[1] Free Elective ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Course Descriptions

The courses for the ITWS program are listed below with a brief description for each.

Humanities, Arts and Social Science Courses

ITWS-1220 IT and Society

Will IT increase prosperity? For whom? What role should governments play in IT development? Do corporations have new responsibilities in the Information Era? What about IT professionals? This course explores the issues, the arguments and working solutions. The first section examines macro indicators and trends. The second section examines the microeconomics and politics of specific arenas - the software industry, the automated work place, telemedicine, and television. The last section explores opportunities for improving society, using IT. This is a communication intensive class. (Cross-listed as IHSS-1220. Students cannot obtain credit for both this course and IHSS-1220.) Spring term annually. *4 credit hours.*

ITWS-2210 Introduction to Human Computer Interaction

An introduction to the current theories, methods, and issues in human-computer interaction. Theory and research along with practical application are discussed within the context of organizational impact. The course provides the knowledge of HCI systems and research used for the implementation of safe, quick, and useable interactive technologies. Spring term annually. *4 credit hours.*

Mathematics and Science Courses

MATH-1010 Calculus I

Functions, limits, continuity, derivatives, implicit differentiation, related rates, maxima and minima, elementary transcendental functions, introduction to definite integral with applications to area and volumes of revolution. Fall and spring terms annually. *4 credit hours*

CSCI-1100 Computer Science I

An introduction to algorithm design and analysis, programming, and use of the World Wide Web for information dissemination and retrieval. Additional topics include basic computer organization; internal representation of scalar and array data; use of top-down design and subprograms to tackle complex problems; abstract data types. Enrichment material as time allows. Interdisciplinary case studies, numerical and non-numerical applications. Prerequisites: none. Fall and spring terms annually. Students who have passed CSCI-1200 cannot register for this course. *4 credit hours*

CSCI-1200 Data Structures

Programming concepts: functions, parameter passing, pointers, arrays, strings, structs, classes, templates. Mathematical tools: sets, functions, and relations, O-notation, complexity of algorithms, proof by induction. Data structures and their representations: data abstraction and internal representation, sequences, trees, binary search trees, associative structures. Algorithms: searching and sorting, generic algorithms, iterative and recursive algorithms. Methods of testing correctness and measuring performance. Prerequisite: CSCI-1100 or permission of instructor. Fall and Spring terms annually. *4 credit hours*

ITWS Core Courses

CSCI-2200 Foundations of Computer Science

This course introduces important mathematical and theoretical tools for computer science, including topics from set theory, combinatorics, and probability theory, and then proceeds to automata theory, the Turing Machine model of computation, and notions of computational complexity. The course will emphasize formal reasoning and proof techniques. Prerequisites: Intro to Calculus (MATH 1010 or MATH 1500) and CSCI 1100. Fall and spring terms annually. *4 credit hours*

CSCI-2220 Programming in Java

Introduction to programming in the Java language. Java is an object-oriented programming language widely used in developing World Wide Web applications. Topics include class declarations and definitions, graphics, threads, exceptions, and writing Web applets. Prerequisite: CSCI 1200 or equivalent. Fall and spring terms annually. 2 c*redit hours*

CSCI-2300 Introduction to Algorithms
Data structures and algorithms, and the mathematical techniques necessary to design and analyze them. Basic data structures: lists, associative structures, trees. Mathematical techniques for designing algorithms and analyzing worst-case and expected-case algorithm efficiency. Advanced data structures: balanced trees, tries, heaps, priority queues, graphs. Searching, sorting. Algorithm design techniques: dynamic programming, greedy algorithms, divide-and-conquer, backtracking. Example graph, string, geometric, and numeric algorithms. Prerequisites: CSCI-1200 and MATH-1010. Fall and spring terms annually. *4 credit hours*

CSCI-2500 Computer Organization
Introduction to computer organization, assembler language, and operating systems. Computer systems organization: processors, memory, I/O. Digital logic: gates, Boolean algebra, digital logic circuits, memory, buses. Microprogramming. Machine level: instruction formats, addressing modes, instruction types, flow of control. Operating systems: virtual memory, virtual I/O instructions, processes, interprocess communication. Numeric representation. Assembler language: the assembly process, macros, linking, loading. Advanced architectures: RISC architectures, parallel architectures. Prerequisite: CSCI-1200. Fall and spring terms annually. *4 credit hours*

CSCI-2961 Programming in Python
Introduction to programming using Python. Python is a programming language with a wide variety of application domains, including Web programming, game development, network programming, scientific and numerical applications, and software development support. Topics include Python syntax, standard libraries, object-oriented programming, image processing, exception handling, list processing, and associative arrays.
Prerequisites/Corequisites: Prerequisite: CSCI 1200. Fall term annually. 2 c*redit hours*

CSCI-4380 Database Systems
Discussion of the state of practice in modern database systems, with an emphasis on relational systems. Topics include database design, database system architecture, SQL, normalization techniques, storage structures, query processing, concurrency control, recovery, security, and new directions such as object-oriented and distributed database systems. Students gain hands-on experience with commercial database systems and interface building tools. Programming projects are required. Prerequisites: CSCI-2300. Fall and spring terms annually. *4 credit hours*

ECSE-2610 Computer Components and Operations
Design-oriented introduction to computer components and operations. Standard codes, number systems, base conversions, and computer arithmetic. Boolean algebra, minimization and synthesis techniques for combinational and sequential logic. Races, hazards, and asynchronous behavior. Registers, arithmetic logic units, memory structure, buses, and control units. Machine language programming, instruction fetch and execution, input-output devices, interrupts, and microprogram sequencers. Software and hardware tools. Students cannot receive credit for both this course and CSCI-2500.
4 credit hours, 6 contact hours

ECSE-2660 Computer Architecture, Networks, and OS
Quantitative basis of modern computer architecture, processor design, memory hierarchy, and input/output methods. Layered operating system structures, process and storage management. Layered network organization, network protocols, switching, local and wide area networks. Examples from Unix and the Internet. Prerequisite: ECSE-2610 or CSCI-2500. Spring term annually. *4 credit hours, 6 contact hours*

ENGR-2350 Embedded Control
Engineering laboratory introduction to the microprocessor as an embedded element of engineering systems. Students simultaneously develop the hardware and software of one or more target systems during the semester. Topics include concepts and practices of microcontroller hardware and software for command, sensing, control, and display. Specifically this includes control of dynamic systems and sensor interfaces; analog-digital conversion; parallel input/output; driver circuits, modular programming, and subsystem integration. Prerequisite: a programming language, preferably C. Fall, spring, and summer terms annually. *4 credit hours*

ITWS-1100 Introduction to Information Technology and Web Science
Information technology focuses on using computing and related technologies to solve problems. Doing this well requires understanding not only the technology itself but also the broader context in which the technology is used. Social, cultural, political, and business issues, for example, can all impact the success or failure of an information technology solution to a problem. These concepts are explored through a variety of projects and hands on activities. The course is intended for anyone interested in finding out what IT is all about. *4 credit hours*

ITWS-2110 Web Systems Development
This course involves a study of the methods used to extract and deliver dynamic information on the World Wide Web. The course uses a hands-on approach in which students actively develop Web-based software systems. Additional topics include installation, configuration and management of Web servers. Students are required to have access to a PC on which they can install software such as a web server and various programming environments. Prerequisites: CSCI-1200 or equivalent. Spring term annually. *4 credit hours.*

ITWS-4310 Managing IT Resources
This course provides an introduction to fundamental concepts of management and applies them to IT. It examines the use of IT in business processes and the management issues of integrating IT into organizational processes to gain competitive advantage. Topics, include: management, organizations and information systems; development life cycle; project management and systems engineering; process reengineering; and organizational learning. Prerequisites: ITWS-2110 or permission of instructor. Fall term annually. *4 credit hours*.

ITWS-4100 IT Capstone Experience
Students work on collaborative projects to design innovative IT solutions, which address a specific problem or area of need in the student's field. Students work to identify a problem and research viable solutions. They go on to propose, design, and prototype their IT solution learning best practices for IT project management, communication and user-center design. This course serves as the culminating experience for the undergraduate IT degree program. Restricted to ITWS Majors. Prerequisites: ITWS-2210 and ITWS-4310. This is a communication intensive class. *4 credit hours*.

ITWS-4350 Data Science
Data science is advancing the inductive conduct of science and is driven by the greater volumes, complexity and heterogeneity of data being made available over the Internet. It combines aspects of data management, library science, computer science, and physical science. It is changing the way all of these disciplines do both their individual and collaborative work. Key methodologies in application areas based on real research experience are taught. Prerequisites/Corequisites: Data Structures (CSCI-1200), Database Systems (CSCI-4380) preferred. Fall semester annually. *3 credit hours.*

ITWS-4400 X-Informatics
Informatics covers a broad range of disciplines addressing challenges in the explosion of data and information resources. Xinformatics provides commonality for implementations in specific disciplines, e.g. X=astro, geo. Informatics' theoretical bases are information and computer science, cognitive science, social science, library science, aggregating these studies and adding the practice of information processing, and the engineering of information systems. This course grounds the material that students will learn in discipline areas by coursework and project assignments. Prerequisites/Corequisites: CSCI-1200 and Data Science (CSCI/ERTH/ITWS-4350/6350). Spring term annually. 3 c*redit hours.*

ITWS-4500 Web Science Systems Development
Building on the technology covered in Web Systems Development, students will be exposed to current technologies, frameworks, and practices in the area of Web development. Types of topics included will be HTML5/CSS3, API's for data, Ruby on Rails, node.js, MongoDB, PHP, and RDF. Methodology to be explored will be application design, software versioning, and team development. Lab intensive, this course is intended to complete a foundation for the advanced courses in Data Science and Advanced Web Science. Restricted to ITWS Majors. Prerequisites – ITWS-2110. Spring term annually. *4 credit hours.*

ITWS-4980 Special Projects
Active participation in a senior-level project supervised by a faculty member and requiring a presentation and project report. Grades of "in-progress" are assigned until the special project has been approved by the faculty member. Prerequisites: Permission of instructor. Fall and spring terms annually. *1-4 credit hours.*

ITWS-4990 Senior Thesis
A two-semester spring-fall or fall-spring course dealing with an advanced level independent research project supervised by a faculty member and requiring the presentation of a thesis. First term registration is limited to second semester juniors and first semester seniors. The grade for the first semester will be listed as "in progress." Prerequisites: Permission of instructor. Fall and spring terms only. 3 c*redit hours.*

MGMT-4170 Data Resource Management
In the course, students learn the technical and managerial aspects of using data-driven technologies at all organizational levels to solve business problems. The focus of the data analysis is on decision making. Students gain hands-on experience through lab components in a studio environment. Students learn the relationship between database design, access and analytics before moving on to advanced data management technologies and issues such as two-dimensional relational database querying, relational on-line analytical processing and data mining. Students will acquire the technical data management skill expected of business analysts. Prerequisite: MGMT-4140. Spring term annually. *4 credit hours.*

Minor in ITWS

The ITWS minor requires a minimum of 16 credit hours that must be approved by the minor advisor in ITWS. The specific requirements are:

1) ITWS-1100 Introduction to Information Technology and Web Science

2) ITWS-4310 Managing IT Resources[1]

3) Humanities Elective (one of):[2]
   ITWS-1220 IT and Society (also listed under IHSS-1220)
   COMM-4790 Social Impact of Electronic Media

4) Technical Elective (one of):
   ITWS-2110 Web Systems Development
   CSCI-2300 Introduction to Algorithms
   CSCI-4380 Database Systems
   MGMT-4170 Data Resource Management

[1] MGMT Majors only – Take ITWS-4100 Information Technology and Web Science Capstone or other course as approved by faculty advisor.

[2] Other courses as approved by faculty advisor.

Arts

(Humanities, Arts and Social Science)

Contact Person: Betty Osganian

Description

The Information Technology and Web Science degree with an Arts concentration presents students with an exciting program of study that emphasizes the creativity of arts studio practice in shaping and influencing information technology. The program extends the activities of the Integrated Electronic Arts program at Rensselaer (iEAR), an extensive, state-of-the-art facility dedicated to interdisciplinary research / artistic development in interactivity, digital video, computer imaging, digital audio, animation, virtual reality, web design, multi-media installation and performance. Students will take a series of courses designed to give them hands-on experience with a full range of arts practice within our unique technological environment. Intermediate and advanced courses offer the student the opportunity to focus on an area of research specialization, and to develop innovative collaborative projects. Study in the Arts concentration will provide students with both theoretical foundation, and practical experience needed for careers in the many fast-growing fields related to digital arts and multi-media.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
Choice of ARTS Intro Class[3]
CSCI-1100 Computer Science I
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
ITWS-1220 IT and Society
Math Elective
Physical Science Elective (PHYS-XXXX)

Semester III

CSCI-2200 Foundations of Computer Science
ITWS-2110 Web Systems Development
HASS Elective[1]
Choice of ARTS Intro Class[3]

Semester IV

CSCI-2500 Computer Organization
ITWS-2210 Intro to Human Computer
ITWS-4500 Web Science Systems Development
ARTS-2540 The Multimedia Century

Semester V

ITWS-4310 Managing IT Resources
Four credits from the following:
- CSCI-2220 Programming in Java (2 cr.)
- CSCI-2961 Programming in Python (2 cr.)
- CSCI-2300 Introduction to Algorithms (4 cr.)

Studio Focus I (see below)
Life Science Elective (BIOL-XXXX)

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

ARTS-4130 New Media Theory
Studio Focus II (see below)
Free Elective

Semester VII	Semester VIII
One of:[2]	ARTS-4420 Experimental Telepresence
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)	HASS Elective[1]
- ITWS-4990 Senior Thesis (Research Track)	Free Elective
Studio Elective (see below)	Free Elective
HASS Elective[1]	ITWS-4990 Senior Thesis (Research Track Only)
HASS Elective[1]	

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

[3] Choose two ARTS Intro classes from following:

ARTS-1010 Music and Sound
ARTS-1020 Media Studio: Imaging
ARTS-1030 Digital Filmmaking

Studio Focus I (one of):

ARTS-2010 Intermediate Video
ARTS-2020 Computer Music
ARTS-2040 Intermediate Digital Imaging

Studio Focus II (one of):

ARTS-4010 Interactive Arts Programming
ARTS-4020 Advanced Digital 3-D Projects
ARTS-4040 Rethinking Documentary: Video Production
ARTS-4050 Professional Collaboration
ARTS-4060 Animation I
ARTS-4070 Animation II
ARTS-4410 Deep Listening
Studio Seminar Topics (rotating topics in current research areas, collaborative projects encouraged, focus on research and development of new technologies).

Studio Elective: 2000 or 4000 level studio course

Civil Engineering
(Engineering)

Contact Person:

Description

Students in this concentration can specialize in one of two areas. The first involves the creation of 3-D and 4-D visualizations of buildings, bridges, highway systems and other kinds of civil systems. These virtual reality environments will be the essence of civil engineering design and construction in the coming millennium. The second specialization focuses on the collection, analysis and dissemination of information concerning the operation of civil systems.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
ENGR-1100 Introduction to Engineering Analysis
CSCI-1100 Computer Science I
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
MATH-1020 Calculus II (Math Elective)
ITWS-1220 IT and Society
Physical Science Elective (PHYS-XXXX)

Semester III

ECSE-2610 Computer Components and Operations
ENGR-2350 Embedded Control
ITWS-2110 Web Systems Development
MATH-2400 Intro to Differential Equations

Semester IV

ECSE-2660 Computer Arch, Networking and OS
ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
Core Engineering Elective

Semester V

ITWS-4310 Managing IT Resources
HASS Elective[1]
Civil Engineering Concentration Elective
Civil Engineering Science Elective

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

ENGR-2600 Modeling and Analysis of Uncertainty
Discipline Elective
Free Elective

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

Life Science Elective (BIOL-XXXX)
HASS Elective[1]
Free Elective

Semester VIII

CIVL-4920 Civil Engineering Capstone Design
HASS Elective[1]
HASS Elective[1]
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2CaraB] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Civil Engineering Science Elective (one of):

PHYS-1200 Physics II
ENGR-1600 Materials Science for Engineers
CHEM-1200 Chemistry II

Core Engineering Elective (one of):

ENGR-2090 Engineering Dynamics
ENGR-2250 Thermal and Fluids Engineering I
ENGR-2530 Strength of Materials
ENGR-4750 Engineering Economics and Project Management

Civil Engineering Concentration Elective (one of):

CIVL-2030 Introduction to Transportation Engineering
CIVL-2630 Introduction to Geotechnical Engineering
CIVL-2670 Introduction to Structural Engineering
ENVE-2110 Introduction to Environmental Engineering

Discipline Elective:

Appropriate technical elective selected in consultation with faculty advisor.

Cognitive Science

(Humanities, Arts and Social Science)

Contact Person: Bram van Heuveln

Description

Cognitive Science applies to IT and Web Science majors in a natural and important way. An understanding of how the human mind takes in and processes information in terms of perception, attention, and memory, will form important guidelines for the actual human usability of any piece of information technology beyond its pure functionality. The Cognitive Science concentration in IT and Web Science thus allows students to incorporate cognitive science knowledge into their design of information technology to create, for example, more efficient and effective human-computer interfaces. However, knowledge about the human mind will also open the doors for information technologies that try to mimic or augment some of the strategies employed by human minds, thus leading to artificially intelligent information technology, or brain-computer interfaces.

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
MATH-1010 Calculus I
IHSS-1140 Minds and Machines

Semester II

CSCI-1200 Data Structures
COGS-2120 Introduction to Cognitive Science
ITWS-1220 IT and Society
Math Elective

Semester III

CSCI-2200 Foundations of Computer Science
HASS Elective[1]
ITWS-2110 Web Systems Development
PSYC-4370 Cognitive Psychology

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
PSYC-2220 Human Factors in Design

Semester V

ITWS-4310 Managing IT Resources
CSCI-2300 Introduction to Algorithms
PSYC-4310 Experimental Methods and Statistics
Life Science Elective (BIOL-XXXX)

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

PSYC-4410 Sensation and Perception
Physical Science Elective (PHYS-XXXX)
HASS Elective[1]

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

PSYC Elective
HASS Elective[1]
Free Elective

Semester VIII

PSYC-4990 Undergraduate Thesis
HASS Elective[1]
Free Elective
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Communication

(Humanities, Arts and Social Science)

Contact Person: Betty Osganian

Description

The Information Technology and Web Science degree with Communication as a concentration prepares students to make effective use of the communication resources in the context of developing information technologies. Students will learn how to integrate oral, visual, and written elements into coherent messages; and to design and manage communication systems so we achieve appropriate blends of media and technologies for specific communication purposes. This degree will prepare students who see Information Technology as a means of taking a leadership role in careers as communication specialists and information officers. Students begin with courses introducing them to the basics of communication theory, literary theory, and written and visual communication, followed by advanced work in one or more of the following areas: communication, film, human-computer interaction, popular culture, technical communication, visual and hypermedia design, web design, and writing.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
WRIT-2110 Rhetoric and Writing
CSCI-1100 Computer Science I
MATH-1010 Calculus I

Semester II

COMM-1510 Intro to Communication Theory
CSCI-1200 Data Structures
ITWS-1220 IT and Society
Math Elective

Semester III

CSCI-2200 Foundations of Computer Science
Free Elective
ITWS-2110 Web Systems Development
COMM-2610 Intro to Visual Communication

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
LITR-2110 Introduction to Literature

Semester V

ITWS-4310 Managing IT Resources
Four credits from the following:
- CSCI-2220 Programming in Java (2 cr.)
- CSCI-2961 Programming in Python (2 cr.)
- CSCI-2300 Introduction to Algorithms (4 cr.)

Communication or Writing Elective
Life Science Elective (BIOL-XXXX)

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

Communication or Writing Elective
HASS Elective[1]
Free Elective

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

Communication or Writing Elective
HASS Elective[1]
Physical Science Elective (PHYS-XXXX)

Semester VIII

Communication Thesis (see list on next page)
HASS Elective[1]
HASS Elective[1]
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Communication Thesis (one of):

COMM-4180 Studio Design in HCI
COMM-4210 Designing Interactive Characters for Digital Games
COMM-4300 Communication Internship
COMM-4420 Foundations of HCI Usability
COMM-4470 Information Design
COMM-4560 Media and Popular Culture
COMM-4690 Interface Design: Hypermedia Theory and Application
COMM-4730 Graphic Design for Corporate Identity

Computer Hardware
(Engineering)

Contact Person: Koushik Kar

Description
Provides students with a strong background in circuits and electronics, with particular application to computer hardware. Topics include basic electronics, microelectronics, electromagnetics, integrated circuit design and computer hardware design.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
MATH-1010 Calculus I
PHYS-1100 Physics I (Science Elective)

Semester II

CSCI-1200 Data Structures
MATH-1020 Calculus II (Math Elective)
PHYS-1200 Physics II (Science Elective)
ITWS-1220 IT and Society

Semester III

ITWS-2110 Web Systems Development
ECSE-2610 Computer Components and Operations
ENGR-2350 Embedded Control
Free Elective

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
ECSE-2660 Computer Arch, Networking and OS
MATH-2400 Introduction to Differential Equations

Semester V

ITWS-4310 Managing IT Resources
ECSE-2010 Electric Circuits
HASS Elective[1]
HASS Elective[1]

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

ECSE-2050 Introduction to Electronics
ECSE-2100 Fields and Waves I
ENGR-2600 Modeling and Analysis of Uncertainty

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

Capstone Experience (one of):
- ECSE-4770 Computer Hardware Design
- ECSE-4220 VLSI Design

ECSE-2210 Microelectronics Technology
HASS Elective[1]

Semester VIII

Any CSCI or ECSE course
HASS Elective[1]
Free Elective
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Students are encouraged to take a Biology course (BIOL-XXXX)

Computer Networking
(Science)

Contact Person: David Kotfila

Description
Prepares students for careers in designing, building and managing computer networks. The concentration provides a background in basic communications techniques, including those for both wired and wireless channels, as well as computer networking so students will understand the network from the physical layer up through the application layer.

Required Courses

Semester I

ITWS-1100 Introduction to ITWS
CSCI-1100 Computer Science I
MATH-1010 Calculus I
PHYS-1100 Physics I (Science Elective)

Semester II

ITWS-1220 IT and Society
CSCI-1200 Data Structures
Math Elective
BIOL-XXXX (Life Science Elective)

Semester III

ITWS-2110 Web Systems Development
Technical Track Course #1
HASS Elective [1]
Free Elective

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
Technical Track Course #2
HASS Elective [1]

Semester V

ITWS-4310 Managing IT Resources
Technical Track Course #3
CSCI-4650 Networking Laboratory I (Concentration)
Free Elective

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

CSCI-4210 Operating Systems (Concentration)
CSCI-4660 Networking Laboratory II (Concentration)
HASS Elective [1]

Semester VII

One of: [2]
- ITWS-4100 ITWS Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

ECSE-4670 Computer Communications Networks (Concentration)
Concentration Elective 1 (Concentration)[3]
HASS Elective [1]
Free Elective [4]

Semester VIII

ITWS-4370 Information Sys. Security (Concentration)
Concentration Elective 2 (Concentration)[3]
CSCI-4220 Network Programming (Concentration)
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

[3] Concentration Electives are 4000 or 6000 level courses, typically in CSCI or ECSE, that are approved by your academic advisor.

[4] Free Elective may be needed to get to 128 credits required for graduation.

Technical Track Courses (Choose based on focus)

Computer Engineering Track (Hardware focus)

1. ECSE-2610 Computer Components and Operations
2. ENGR-2350 Embedded Control
3. ECSE-2660 Computer Architecture, Networking and Operating Systems

Computer Science Track (Software focus)

1. CSCI-2200 Foundations of Computer Science
2. CSCI-2300 Introduction to Algorithms
3. CSCI-2500 Computer Organization

Data Science

(Information Technology and Web Science)

Contact Person: Peter Fox

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
Life Science Elective (BIOL-XXXX)
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
Math Elective
ITWS-1220 IT and Society
Free Elective

Semester III

ITWS-2110 Web Systems Development
CSCI-2200 Foundations of Computer Science
CSCI-2500 Computer Organization
Physical Science Elective (PHYS-XXXX)

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
Web/Data Course approved by ITWS Curriculum Committee
Choose one:
- CSCI-2220 Programming in Java (Conc.)
- CSCI-2961 Programming in Python (Conc.)

HASS Elective [1]

Semester V

ITWS-4310 Managing IT Resources
CSCI-4150 Intro to Artificial Intelligence (Concentration)
CSCI-4210 Operating Systems (Concentration)
Statistics Sequence A* (Concentration)

Semester VI

CSCI-4220 Network Programming (Concentration)
CSCI-4380 Database Systems
HASS Elective [1]
Free Elective (6-7 credits)**

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

ITWS-4350 Data Science (Concentration)
CSCI-4100 Machine and Computational Learning (Concentration)
HASS Elective[1]

Semester VIII

ITWS-4400 X-Informatics (Concentration)
Free Elective
HASS Elective[1]
Statistics Sequence B* (Concentration)
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

***<u>Statistics Sequences (Choose either Sequence 1 or 2):</u>**

Sequence 1 – Math

A. MATP-4600 Probability Theory and Applications
B. MATP-4620 Mathematical Statistics

Sequence 2 – Engineering

A. ENGR-2600 Modeling and Analysis of Uncertainty (4 credits)
B. ISYE-6180 Knowledge Discovery with Data Mining (3 credits)

**Number of free elective credits in Semester VI will be 6-7 credits. There are two factors that determine the correct number: (1) Statistics Sequence choice and; (2) two courses in later terms are only 3 credits each.

Economics

(Humanities, Arts and Social Science)

Contact Person: Faye Duchin

Description

The BS in Information Technology and Web Science with Economics as the concentration prepares students for careers in the intersection of information technology and the global economy. Graduates with this concentration will be trained in the application of new information technologies to specific economic fields of study such as global economics, regional economics, and environmental/ecological economies. The widespread availability of techniques such as GIS mapping is beginning to revolutionize economic analysis and has the potential to change the way we view the economic system and the world we live in. As the information revolution penetrates the classroom, courses will increasingly be taught around local, national, and global databases. Graduates will have a variety of career options ranging from local governments and local development agencies, to worldwide economic development and environmental organizations. All students begin by taking *Introduction to Economics: The Global Economics in the Information Age* (first year studies), which provides an introduction to economic theory, and a hands-on, project-based introduction to the economics of the information age.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
MATH-1010 Calculus I
ECON-1200 Introductory Economics

Semester II

CSCI-1200 Data Structures
ITWS-1220 IT and Society
MATH-1520 Mathematical Methods in Management and Economics
HASS Elective[1]

Semester III

CSCI-2200 Foundations of Computer Science
ITWS-2110 Web Systems Development
ECON-2010 Managerial Economics
Life Science Elective (BIOL-XXXX)

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
ECON Elective

Semester V

ITWS-4310 Managing IT Resources
Four credits from the following:
- CSCI-2220 Programming in Java (2 cr.)
- CSCI-2961 Programming in Python (2 cr.)
- CSCI-2300 Introduction to Algorithms (4 cr.)

One of:
ECON-4120 Mathematical Methods in Economics
ECON-4570 Econometrics
One of the following two courses:
ECON-4130 Money and Banking
ECON-2020 Intermediate Macroeconomics

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

ECON Elective
HASS Elective[1]
Free Elective

Semester VII	Semester VIII
One of:[2] - ITWS-4100 Information Technology and Web Science Capstone (Professional Track) - ITWS-4990 Senior Thesis (Research Track) ECON-4yyy Senior Economics Capstone or similar HASS Elective[1] Free Elective	Economics elective Physical Science Elective (PHYS-XXXX) HASS Elective[1] Free Elective ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Entrepreneurship

(Management)

Contact Person: Peggy McDermott

Description

In combination with the Information Technology and Web Science core, the Entrepreneurship concentration leads to a multidisciplinary degree with a special emphasis on technological entrepreneurship in the information technology field. This concentration focuses on the process of discovering, creating and turning information technology-based opportunities into new products in existing organizations and new ventures.

The Entrepreneurship concentration curriculum is designed to provide a solid foundation of skills, knowledge and practical field experience at the intersection of information technology and entrepreneurship. It emphasizes recognizing new product and/or new venture opportunities; creating business plans to bring them into existence, and managing the launch, growth and harvest of information technology and web science-based opportunities.

Students interested in the following career possibilities should pursue an Entrepreneurship concentration: new product development and/or corporate venturing in larger, entrepreneurial businesses; multidisciplinary opportunities in newer, high potential ventures; and direct participation in the creation of a new, information technology and web science-based venture.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
MATH-1010 Calculus I
MGMT-1100 Introduction to Management

Semester II

CSCI-1200 Data Structures
ITWS-1220 IT and Society
MGMT-2300 Fundamentals of Accounting for Decision Making
Math Elective

Semester III

CSCI-2200 Foundations of Computer Science
ITWS-2110 Web Systems Development
HASS Elective[1]
Free Elective

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
MGMT-2320 Managerial Finance

Semester V

ITWS-4310 Managing IT Resources
Four credits from the following:
- CSCI-2220 Programming in Java (2 cr.)
- CSCI-2961 Programming in Python (2 cr.)
- CSCI-2300 Introduction to Algorithms (4 cr.)

MGMT-4510 Invention, Innovation, and Entrepreneurship
Life Science Elective (BIOL-XXXX)

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

One of:
- MGMT-4850 Organizational Behavior in High Performance Organizations
- MGMT-4860 Human Resources in High Performance Organizations

HASS Elective[1]
Physical Science Elective (PHYS-XXXX)

Semester VII	Semester VIII
One of:[2] - ITWS-4100 Information Technology and Web Science Capstone (Professional Track) - ITWS-4990 Senior Thesis (Research Track) MGMT-2430 Marketing Principles MGMT-4520 Introduction to Technological Entrepreneurship HASS Elective[1]	MGMT-4530 Starting Up a New Venture HASS Elective[1] Free Elective ITWS-4990 Senior Thesis (Research Track Only) Free Elective

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Finance
(Management)

Contact Person: Peggy McDermott

Description

The Finance concentration prepares students for careers in the financial sector and in corporate finance functions. To complement the Information Technology and Web Science core, the student will experience financial analysis and trading, financial decision-making, and their applications. Special finance problems in high-tech industries will be explored, as well as the impact of technology on financial markets, financial institutions, and financial management in modern corporations. This concentration provides an in-depth understanding of investment decision making and risk management including stocks, bonds, options, futures, and swaps; that is, the elements of financial engineering. You'll be expected to take additional information systems and operation research courses.

The capstone course will closely integrate the ITWS and MIS course experiences in an extended application involving either corporate financial information systems or real time trading and market information management.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
MGMT-1100 Introduction to Management
CSCI-1100 Computer Science I
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
ITWS-1220 IT and Society
MGMT-2300 Fundamentals of Accounting for Decision Making
Math Elective

Semester III

CSCI-2200 Foundations of Computer Science
ITWS-2110 Web Systems Development
HASS Elective[1]
Free Elective

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
MGMT-2320 Managerial Finance

Semester V

ITWS-4310 Managing IT Resources
Four credits from the following:
- CSCI-2220 Programming in Java (2 cr.)
- CSCI-2961 Programming in Python (2 cr.)
- CSCI-2300 Introduction to Algorithms (4 cr.)

MGMT-4320 Investments I
Life Science Elective (BIOL-XXXX)

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

MGMT-4330 Investments II
HASS Elective[1]
MGMT-4340 Advanced Corporate Finance

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

MGMT-4370 Risk Management
HASS Elective[1]
Free Elective

Semester VIII

One of:
- MGMT-2430 Marketing Principles
- MGMT-4850 Organizational Behavior in High Performance Organizations
- MGMT-4860 Human Resources in High Performance Organizations

Physical Science Elective (PHYS-XXXX)
Free Elective
HASS Elective[1]
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Information Security

(Information Technology and Web Science)

Contact Person: David Spooner

Description

The Information Security concentration prepares students for careers designing, building, and managing secure computer systems and networks. The concentration includes 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 others who expect to follow a different career path but want a comprehensive background in information assurance.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
PHYS-1100 Physics I (Science Elective)
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
Math Elective
ITWS-1220 IT and Society
Life Science Elective (BIOL-XXXX)

Semester III

ITWS-2110 Web Systems Development
CSCI-2200 Foundations of Computer Science
CSCI-2500 Computer Organization
HASS Elective[1]

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2300 Introduction to Algorithms
Select one of:
PHIL-2100 Critical Thinking
PHIL-4240 Ethics
STSH-4250 Bioethics

Semester V

ITWS-4310 Managing IT Resources
CSCI-4210 Operating Systems
Stream Course #1*
Free Elective

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

CSCI-4220 Network Programming
Stream Course #2*
HASS Elective[1]

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

CSCI-4230 Cryptography & Network Security I
HASS Elective[1]
HASS Elective[1]

Semester VIII

ITWS-4370 Information System Security
Stream Course #3*
Free Elective
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

*Students select and follow one stream taking all three courses in their selected stream:

Stream: Cryptography

1. MATH-1020 Calculus II
2. MATH-4020 Introduction to Number Theory
3. CSCI-4240 Cryptography & Network Security II

Stream: Application Systems

1. ITWS-4400 X-Informatics
2. CSCI-4020 Computer Algorithms or CSCI-4150 Introduction to Artificial Intelligence
3. CSCI-4390 Database Mining

Stream: Risk Assessment

1. MGMT-2300 Fundamentals of Accounting for Decision Making
2. MGMT-2320 Managerial Finance
3. MGMT-4370 Risk Management

Stream: Network Systems

1. CSCI-4650 Networking Laboratory I
2. CSCI-4670 Networking Security Lab
3. ECSE-4670 Computer Communications Networks

Machine and Computational Learning

(Science)

Contact Person: Mark Goldberg and Malik Magdon-Ismail

Description

This concentration of study prepares a student to work in the areas of Information Technology and Web Science that involve the development of intelligent systems for complex computational tasks in areas such as bioinformatics, voice and image recognition, and Internet development. The knowledge of the methods of machine and computational learning enables the student not only to identify situations where intelligent algorithms would amplify performance, but also to develop such algorithms.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
Physical Science Elective (PHYS-XXXX)
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
Math Elective
ITWS-1220 IT and Society
HASS Elective[2]

Semester III

ITWS-2110 Web Systems Development
CSCI-2200 Foundations of Computer Science
CSCI-2500 Computer Organization
Machine Learning Elective[1]

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2300 Introduction to Algorithms
Free Elective

Semester V

ITWS-4310 Managing IT Resources
Life Science Elective (BIOL-XXXX)
Machine Learning Elective[1]
HASS Elective[2]

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

CSCI-4150 Intro to Artificial Intelligence
Machine Learning Elective[1]
HASS Elective[2]

Semester VII

One of: [3]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

Machine Learning Elective[1]
Machine Learning Elective[1]
Free Elective

Semester VIII

ISYE-4810 Computational Intelligence
Machine Learning Elective[1]
HASS Elective[2]
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] Machine Learning Electives – See approved list next page

[2] See HASS requirements listed in the front of this document.

[3] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Machine Learning Electives may be chosen from among:

CSCI-4020 Computer Algorithms
CSCI-4380 Database Systems
CSCI-4390 Database Mining

ECSE-4540 Introduction Image Processing

PHIL-2140 Introduction to Logic
PHIL-4260 Philosophy of Artificial Intelligence
PHIL-4380 Philosophy of Mathematics
PHIL-4420 Computability and Logic
PHIL-4440 Knowledge and Rationality

The following graduate courses can be used as Machine Learning Electives with the permission of either Prof. Goldberg or Prof. Magdon-Ismail: CISH-6150 AI and Heuristics, ECSE-6610 Pattern Recognition, and ECSE-6720 Neural Network Computing.

Management Information Systems

(Management)

Contact Person: Peggy McDermott

Description

The Management Information Systems concentration prepares you for careers in information systems analysis and programming, design, management, and consulting. Beyond the Information Technology and Web Science curriculum and the management core, the student will cover such topics as systems analysis, telecommunications, database design, and computer programming.

The capstone course will closely integrate the ITWS and MIS course experiences in an extended application, possibly with a large local company.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
MGMT-1100 Introduction to Management
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
Math Elective
MGMT-2300 Fundamentals of Accounting for Decision Making
ITWS-1200 IT and Society

Semester III

ITWS-2110 Web Systems Development
CSCI-2200 Foundations of Computer Science
HASS Elective[1]
Free Elective

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
MGMT-2320 Managerial Finance

Semester V

ITWS-4310 Managing IT Resources
Four credits from the following:
- CSCI-2220 Programming in Java (2 cr.)
- CSCI-2961 Programming in Python (2 cr.)
- CSCI-2300 Introduction to Algorithms (4 cr.)

MGMT-2430 Marketing Principles
Life Science Elective (BIOL-XXXX)

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

MGMT-4240 Systems Analysis and Design
Physical Science Elective (PHYS-XXXX)
HASS Elective[1]

Semester VII	Semester VIII
One of:[2] - ITWS-4100 Information Technology and Web Science Capstone (Professional Track) - ITWS-4990 Senior Thesis (Research Track) MGMT-4130 Enterprise IT Integration MGMT-4150 IT Project Management HASS Elective[1]	One of: - MGMT-4850 Organizational Behavior in High Performance Organizations - MGMT-4860 Human Resources in High Performance Organizations HASS Elective[1] ITWS-4990 Senior Thesis (Research Track Only) Free Elective Free Elective

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Mechanical / Aeronautical Engineering

(Engineering)

Contact Person: Diana Borca-Tasciuc

Description

For those ITWS students with an interest in aviation systems, the Aeronautics track provides an introduction to the fundamentals of flight technology. The Mechanical track, on the other hand prepares one for a more broad-based career in thermofluids engineering and mechatronic systems.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
ENGR-1100 Introduction to Engineering Analysis
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
PHYS-1100 Physics I (Science Elective)
MATH-1020 Calculus II (Math Elective)
ITWS-1220 IT and Society

Semester III

ITWS-2110 Web Systems Development
ECSE-2610 Computer Components and Operations
ENGR-2350 Embedded Control
PHYS-1200 Physics II (Science Elective)

Semester IV

ITWS-4500 Web Science Systems Development
ECSE-2660 Computer Arch, Networks and OS
ENGR-2530 Strength of Materials
MATH-2400 Differential Equations

Semester V

ITWS-4310 Managing IT Resources
Track Option 1
ENGR-2600 Modeling and Analysis of Uncertainty
Free Elective

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

ITWS-2210 Intro. to Human Computer Interaction
MANE-4050 Modeling and Control of Dynamic Sys.
Free Elective

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

Track Option 2
HASS Elective[1]
HASS Elective[1]

Semester VIII

ENGR-2090 Engineering Dynamics
HASS Elective[1]
HASS Elective[1]
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Students are encouraged to take a Biology course (BIOL-XXXX)

Track Option 1 (one of):
MANE-2060 Fundamentals of Flight (Aeronautical Track)
ENGR-2250 Thermal and Fluids Engineering I (Mechanical Track)

Track 2 (one of):
MANE-4060 Aerospace Structures and Materials (Aeronautical Track)
MANE-4490 Mechatronics (Mechanical Track)

A student must choose either the Aeronautical Track or the Mechanical Track for Track Options 1 and 2 and for the Restricted Track Elective. Courses cannot be intermixed between the two tracks.

Medicine
(Science)

Contact Person: Michael Hanna

Description

Modern physicians are caregivers, small business persons, and community leaders. They are bombarded with information from medical journals, pharmaceutical companies, insurance companies and HMOs to mention a few. They collect information from the mundane realms of scheduling and billing to precise documentation needed for patient records and outcome studies. They are well equipped to provide care but overwhelmed by the information flow. The standard undergraduate curriculum for students applying to medical school has not changed in 30 years. Certainly, students need the basic science courses in order to perform well in medical school. The ITWS concentration in medicine will provide the premedical requirements and a fresh approach toward information management. A physician trained in the ITWS curriculum will be able to lead the profession into the next century where information flow will dominate both in diagnostics and management. New technologies and new mechanisms of providing care drive the practice of medicine. The application of information technology to these expanding areas will be the next wave as medicine struggles to keep up. Without appropriate information guidance and flow, the next generation of physicians will be overwhelmed.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
CHEM-1100 Chemistry I
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
MATH-1020 Calculus II (Math Elective)
HASS Elective[1]
ITWS-1220 IT and Society

Semester III

ITWS-2110 Web Systems Development
CSCI-2200 Foundations of Computer Science
CHEM-1200 Chemistry II
BIOL-1010 Intro to Biology (Science Elective)

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
BIOL-2120 Intro to Cell and Molecular Biology

Semester V

ITWS-4310 Managing IT Resources
Four credits from the following:
- CSCI-2220 Programming in Java (2 cr.)
- CSCI-2961 Programming in Python (2 cr.)
- CSCI-2300 Introduction to Algorithms (4 cr.)

CHEM-2250 Organic Chemistry I
PHYS-1100 Physics I (Science Elective)

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

CHEM-2260 Organic Chemistry II
PHYS-1200 Physics II
HASS Elective[1]

Semester VII	Semester VIII
One of:[2] - ITWS-4100 Information Technology and Web Science Capstone (Professional Track) - ITWS-4990 Senior Thesis (Research Track) BIOL-4270 Human Physiology Free Elective HASS Elective[1]	ITWS-4940 Capstone - Concentration HASS Elective[1] Free Elective Free Elective ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Pre-Law

(Humanities, Arts and Social Science)

Contact Person: Atsushi Akera(Values and Public Policy Track) Mike Kalsher (Psychology Track)

Description

The Pre-Law concentration with the Values and Public Policy track will earn you a dual degree with Science, Technology, and Society. STS has an established sequence of pre-law, ethics, and public policy courses that will place you in a great position for an advanced degree in law, public administration, or public policy. Pre-law students from ITWS who pursue this track will be especially well positioned for a law degree in patent, Internet, and intellectual property law. Students who have pursued the STS pre-law track have been accepted at many of the nation's top law schools.

The Pre-Law concentration with the Psychology track focuses on the interplay between psychology and logic and the legal system.

A student can choose either the Values and Public Policy Track or the Psychology Track. Each semester lists courses 1 through 8 in which the student must select the appropriate course from the chosen track. Courses cannot be intermixed between the two tracks.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
HASS Elective[1]
CSCI-1100 Computer Science I
Course 1

Semester II

CSCI-1200 Data Structures
Course 2
MATH-1010 Calculus I
ITWS-1220 IT and Society

Semester III

ITWS-2110 Web Systems Development
CSCI-2200 Foundations of Computer Science
Course 3
Math Elective

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
Course 4

Semester V

ITWS-4310 Managing IT Resources
Four credits from the following:
- CSCI-2220 Programming in Java (2 cr.)
- CSCI-2961 Programming in Python (2 cr.)
- CSCI-2300 Introduction to Algorithms (4 cr.)

Course 5
Life Science Elective (BIOL-XXXX)

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

Course 6
HASS Elective[1]
Free Elective

Semester VII	Semester VIII
One of:[2] - ITWS-4100 Information Technology and Web Science Capstone (Professional Track) - ITWS-4990 Senior Thesis (Research Track) Course 7 Physical Science Elective (PHYS-XXXX) Free Elective	Course 8 HASS Elective[1] HASS Elective[1] Free Elective ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

For selection of concentration courses and HASS Electives, see the appropriate contact person above.

Psychology Track:
Course-1: PSYC-1200 General Psychology
Course-2: PSYC-2730 Social Psychology
Course-3: PHIL-2140 Introduction to Logic
Course-4: Law and Computing Elective
Course-5: PSYC-4740 Psychology and the Law
Course-6: WRIT-2110 Rhetoric and Writing
Course-7: MGMT-1100 Introduction to Management
Course-8: PSYC-4990 Undergraduate Thesis

Values and Public Policy Track:
Course-1: STSS-1110 Science, Technology, and Society
Course-2: STSS-2350 Law, Values, and Public Policy: Perspectives on Science and Technology
Course-3: STSS 2000 Level Concentration Course
Course-4: STSS 2000 Level Concentration Course
Course-5: STSS 4000 Level Concentration Course
Course-6: STSS 4000 Level Concentration Course
Course-7: STSS-4800 Public Service/Professional Careers Internships
Course-8: STSS-4980 Senior Project

Psychology

(Humanities, Arts and Social Science)

Contact Person: Chris Verwys

Description

The Psychology concentration in the ITWS focuses on the human element in Information Technology and Web Science. An understanding of how individuals process information, or cognitively respond to pieces of Information Technology and Web Science in terms of motivation or performance allows for better design of such systems. Moreover, social and organizational psychology will inform students as to how groups or organizations share and process information or make decisions, and this knowledge will be crucial in the development of new information and web technologies that allow groups to use them effectively and efficiently.

Required Courses (Human-Computer Interface/Cognitive Engineering Track)

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
MATH-1010 Calculus I
IHSS-1140 Mind and Machines

Semester II

CSCI-1200 Data Structures
PSYC-1200 General Psychology
ITWS-1220 IT and Society
Math Elective

Semester III

ITWS-2110 Web Systems Development
CSCI-2200 Foundations of Computer Science
PSYC-2220 Human Factors in Design
HASS Elective[1]

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
PSYC-4110 Motivation and Performance

Semester V

ITWS-4310 Managing IT Resources
Four credits from the following:
- CSCI-2220 Programming in Java (2 cr.)
- CSCI-2961 Programming in Python (2 cr.)
- CSCI-2300 Introduction to Algorithms (4 cr.)

PSYC Elective
Life Science Elective (BIOL-XXXX)

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

Physical Science Elective (PHYS-XXXX)
PSYC Elective
HASS Elective[1]

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

PSYC-4200 Industrial and Organizational Psychology
HASS Elective[1]
Free Elective

Semester VIII

PSYC-4990 Undergraduate Thesis
HASS Elective[1]
Free Elective
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Required Courses (Industrial/Organizational Psychology Track)

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
PSYC-1200 General Psychology
CSCI-1100 Computer Science I
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
ITWS-1220 IT and Society
HASS Elective[1]
Math Elective

Semester III

ITWS-2110 Web Systems Development
CSCI-2200 Foundations of Computer Science
PSYC-2730 Social Psychology
Free Elective

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
PSYC-4310 Exp. Methods and Statistics

Semester V

ITWS-4310 Managing IT Resources
Four credits from the following:
- CSCI-2220 Programming in Java (2 cr.)
- CSCI-2961 Programming in Python (2 cr.)
- CSCI-2300 Introduction to Algorithms (4 cr.)

PSYC-4200 Industrial and Organizational Psychology
Life Science Elective (BIOL-XXXX)

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

PSYC-XXXX Elective
Physical Science Elective (PHYS-XXXX)
HASS Elective[1]

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

PSYC-4110 Motivation and Performance
HASS Elective[1]
Free Elective

Semester VIII

PSYC-4990 Undergraduate Thesis
PSYC-XXXX Elective
HASS Elective[1]
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Science and Technology Studies: Information and Society

(Humanities, Arts and Social Science)

Contact Person: Atsushi Akera

Description

Whether they are in business, government, or the professions, Science and Technology Studies (STS) graduates report that they are uniquely prepared to understand today's multi-faceted problems. STS is a perfect companion to ITWS for those students who wish to combine their technical expertise in ITWS with a deep understanding of ITWS's place in the world. The STS Department has achieved an international reputation for its research and teaching on the social effects of science and technology and, likewise, the impact of society on the shaping of science and technology. STS faculty draw on anthropology, history, philosophy, political science, sociology, and social psychology to develop unique interdisciplinary courses about the place of science and technology in today's world. Students generally specialize in a cluster of courses in one of the five main "tracks": information and society, environment and society, health and society, engineering and society, and law, values, and public policy. The information and society track a selection of more advanced courses such as *Ethical Issues in Computing*, and *History of Information Technology*. A special public service internship allows students to gain hands-on experience in a local nonprofit, government or public-service organization. Some students with STS degrees go on to graduate programs in law, management, social science, public policy, public health and medicine. The rest enter the workforce immediately, often in government, the nonprofit sector, or in consulting firms. It is possible to develop a dual major between ITWS and STS by taking the designated sequence of eight courses that is indicated in the following template.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
STSS-1110 Science, Technology, and Society
CSCI-1100 Computer Science I
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
ITWS-1220 IT and Society
HASS Elective[1]
Math Elective

Semester III

ITWS-2110 Web Systems Development
CSCI-2200 Foundations of Computer Science
2000 Level STSS Course
Life Science Elective (BIOL-XXXX)

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
One of:
- STSS-2200 Engineering, Design, and Society
- STSS-2350 Law, Values and Public Policy: Perspectives on Science and Technology

Semester V

ITWS-4310 Managing IT Resources
Four credits from the following:
- CSCI-2220 Programming in Java (2 cr.)
- CSCI-2961 Programming in Python (2 cr.)
- CSCI-2300 Introduction to Algorithms (4 cr.)

STSH-4210 Engineering Ethics
4000 Level STS Course

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

STSS-4800 Public Service/Professional Careers Internships
Physical Science Elective (PHYS-XXXX)
HASS Elective[1]

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

4000 Level STS Course
HASS Elective[1]
Free Elective

Semester VIII

STSS-4980 STS Senior Project (Capstone)
HASS Elective[1]
Free Elective
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Science Informatics

(Science)

Contact Person: David Spooner (Biology Track)
Ron Bailey (Chemistry Track)
Sandra Nierzwicki-Bauer (Ecology Track)

Description

Chemistry Track

The drive in pharmaceutical research currently (and most certainly in the decades to come) is the human genome project (HGP). The information stored in our 3 billion base pairs is a "gold mine" for new molecular targets to treat diseases with huge unmet therapeutic need (e.g., AIDS, cancer). Millions of gene sequences will translate into thousands of high throughput screens (HTS). Thousands of HTSs will require millions of new chemicals. Millions of new chemicals will require millions of inputs regarding structure, purity, diversity, etc. There is no way the technology currently available in the industry can cope with these numbers. With the advent of combinatorial chemistry (CombiChem) there is unprecedented demand for synthetic chemists as well as CombiChem and chemical information scientists. A perusal of the chemistry trade publication Chemical & Engineering News will verify this demand.

The volume of data that will derive from HGP - HTS - CombiChem is enormous and Rensselaer, though its ITWS program, can help the industry and humankind by supplying the chemical and biological scientists to generate, handle, and analyze these data. There will be a "magic bullet" some day soon for treating cancer and it will come from the HPG - HTS - CombiChem approach.

Ecology Track

The Ecology Track is designed to serve students with ecological interest in topics ranging from global change to water quality. The expansive environmental datasets that exist as well as new kinds of environmental and ecological data emerging from the application of more sophisticated and sensitive instrumentation, requires scientists that have the ability to process this information in meaningful ways. The application of information technology for addressing ecological issues using extensive datasets describes the emerging field of “ecoinformatics”. In this unique program students will take advantage of the basic Information Technology core that requires courses including data structures and systems, probability and statistics, as well taking courses in biology and ecology.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
MATH-1010 Calculus I
CSCI-1100 Computer Science I
CHEM-1100 Chemistry I (Science Elective)

Semester II

CSCI-1200 Data Structures
ITWS-1220 IT and Society
CHEM-1200 Chemistry II (Science Elective)
HASS Elective[1]

Semester III

ITWS-2110 Web Systems Development
CSCI-2200 Foundations of Computer Science
Track Option 1
MATH-1020 Calculus II (Math Elective)

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
CSCI-2500 Computer Organization
Track Option 2

Semester V

ITWS-4310 Managing IT Resources
Web/Data Course approved by ITWS Curriculum Committee
Track Option 3
Track Option 4

Semester VI

ITWS Elective (one of):
- CSCI-4380 Database Systems
- MGMT-4170 Data Resource Management

Track Option 5
HASS Elective[1]
Free Elective

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

Track Option 6
HASS Elective[1]
Free Elective

Semester VIII

Track Option 7
Track Option 8
HASS Elective[1]
Free Elective
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1] See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Track Option 1 (one of):
CHEM-2250 Organic Chemistry I (Biology Track)
CHEM-2250 Organic Chemistry I (Chemistry Track)
BIOL-1010 Introduction to Biology

Track Option 2 (one of):
BIOL-2120 Intro to Cell and Molecular Biology (Biology Track)
CHEM-2260 Organic Chemistry II (Chemistry Track)
BIOL-2120 Intro to Cell and Molecular Biology (Ecology Track)

Track Option 3 (one of):
CHEM-4760 Molecular Biochemistry I (Biology Track)
CHEM-4760 Molecular Biochemistry I (Chemistry Track)
Ecology Elective

Track Option 4 (one of):
BIOL-2500 Genetics and Evolution (Biology Track)
CHEM-4530 Modern Techniques in Chemistry (Chemistry Track)
BIOL-4850 Principals of Ecology (Ecology Track)

Track Option 5 (one of):
BIOL-4620 Molecular Biology I (Biology Track)
CHEM-4770 Molecular Biochemistry II or CHEM-4300 Medicinal Chemistry (Chemistry Track)
BIOL-2500 Genetics and Evolution (Ecology Track)

Track Option 6 (one of):

BIOL-4540 Sequence Analysis (Biology Track)
CHEM-496X Computational Chemistry (Chemistry Track)
ERTH- 4500 Earth's Climate: Past, Present and Future (Ecology Track)

Track Option 7 (one of):

BIOL-4550 Molecular Modeling (Biology Track)
CHEM-4330 Drug Discovery (Chemistry Track)
BIOL- 4XXX Ecoinformatics (Ecology Track)

Track Option 8 (one of):

✶BIOL- 4720 Molecular Biology Laboratory (Biology Track)
CHEM- 4XXX Chemistry Informatics (Chemistry Track)
Ecology Elective (Ecology Track)

Ecology Elective: (one of):

- BIOL-4680 Applied and Environmental Microbiology
- BIOL-4700 Freshwater Ecology
- IENV-4700 One Mile of the Hudson River
- ENVE-6150 Limnology
- BIOL-YYYY Molecular Methods for Ecological Studies

A student can choose the Biology Track, Chemistry Track or the Ecology Track for all track options. Courses cannot be intermixed between the tracks.

✶Swap with free elective in semester VII.

Web Technologies

(Science)

Contact: Jim Hendler

Description

The Web Technologies concentration provides students with the skills necessary to plan build and assess effective and efficient web-based information systems. By focusing on the technical aspects of building these web-based systems, it is an alternative to other concentrations and degree programs that focus instead on development of web content. Students in the Web Technologies concentration develop expertise in systems-level and applications-level programming concepts through coursework in database systems, operating systems and networking programming. Additional coursework on software design focuses on large-scale systems modeling and development. Collectively, this coursework provides a strong background for web-based systems development. To complete the concentration, students develop expertise in communicating information effectively with the help of courses in visual communication, usability and cognitive science. Students who complete the Web Technologies concentration are well-prepared for a career in the technical branch of a small or large company with responsibility for development and operation of sophisticated web-based systems.

Required Courses

Semester I

ITWS-1100 Introduction to Information Technology and Web Science
CSCI-1100 Computer Science I
Life Science Elective (BIOL-XXXX)
MATH-1010 Calculus I

Semester II

CSCI-1200 Data Structures
Math Elective
ITWS-1220 IT and Society
Free Elective

Semester III

ITWS-2110 Web Systems Development
CSCI-2200 Foundations of Computer Science
CSCI-2500 Computer Organization
Physical Science Elective (PHYS-XXXX)

Semester IV

ITWS-2210 Intro to Human Computer Interaction
ITWS-4500 Web Science Systems Development
Web/Data Course approved by ITWS Curriculum Committee
HASS Elective[1]

Semester V

ITWS-4310 Managing IT Resources
CSCI-2220 Programming in Java (Concentration)
CSCI-2961 Programming in Python (Concentration)
CSCI-4210 Operating Systems (Concentration)
HASS Elective[1]

Semester VI

CSCI-4220 Network Programming (Concentration)
Intelligent Systems Elective (Concentration)
Communication Design Elective (Concentration)
Free Elective

Semester VII

One of:[2]
- ITWS-4100 Information Technology and Web Science Capstone (Professional Track)
- ITWS-4990 Senior Thesis (Research Track)

CSCI-4380 Database Systems
Assessment Elective (Concentration)
HASS Elective[1]

Semester VIII

Computing Elective (Concentration)
Free Elective
HASS Elective[1]
Database Elective (Concentration)
ITWS-4990 Senior Thesis (Research Track Only)

Students must satisfy an 8-credit communication requirement. See your advisor for details.

[1]See HASS requirements listed in the front of this document.

[2] Co-terminal students would replace ITWS-4100 Information Technology and Web Science Capstone with ITWS-4980 Special Projects course which will be the culminating experience.

Web Technologies Concentration (32 Credits)

1. CSCI-2220 Programming in Java (2 credits)

2. CSCI-2961 Programming in Python (2 credits)

3. CSCI-4210 Operating Systems

4. Communication Design Elective (one of):
- COMM-2610 Introduction to Visual Communication
- COMM-4460 Visual Design: Theory and Application
- COMM-4520 Information Architecture
- COMM-4650 Marketing Communication Design
- COMM-4660 Visual Literacy

5. CSCI-4220 Network Programming

6. Intelligent Systems Elective (one of):
- COGS-4210 Cognitive Modeling I
- ISYE-4810 Computational Intelligence
- CSCI-4100 Machine and Computational Learning
- CSCI-4150 Introduction to Artificial Intelligence

7. Assessment Elective (one of):
- COMM-4420 Foundations of HCI Usability
- COMM-4180 Studio Design in HCI (only when COMM-4420 is not offered)
- ISYE-4760 Mathematical Statistics

8. Computing Elective (one of):
- CSCI-4020 Computer Algorithms
- CSCI-4320 Parallel Programming
- CSCI-4430 Programming Languages
- ECSE-4750 Computer Graphics
- ITWS-494X Web Technologies Project

9. Database Elective (one of):
- CSCI-4390 Database Mining
- CSCI-4100 Machine and Computational Learning
- CSCI-4150 Introduction to Artificial Intelligence
- CSCI-4440 Software Design and Documentation