Computing and Design

Smith Computer Center (Classrooms)
Burns North CIT Suite (Faculty Offices)
http://cit.dixie.edu/

To find faculty & staff phone numbers and email addresses, please consult the University Directory (http://www.dixie.edu/directory/directory.php).

Department Chair
Russ Ross, Ph.D.

Administrative Secretary
TBA

Advisor
Nikki Dang, M.Ed.

Dean
Eric Pedersen, Ph.D.

Administrative Assistant
Ruth Bruckert

Program Description
The Computing and Design programs at DSU are proud to provide students with the latest equipment and software, as well as a strong faculty who can teach students to use resources well. The Computing and Design programs prepare students for a multitude of computer related careers including UI/UX, app development, systems administration, security and networking, software engineering, and computer science.

The department offers students three Bachelor degrees: Computer Science (CS), Computer & Information Technology (CIT), and Design.

The CS degree is a standalone Bachelor Science degree.

Within the CIT degree, there is a general program as well as the option to focus on one of three areas: Information Technology, Software Development, or Web Design & Development.

The Design degree offers students three emphases under a Bachelor of Science or Bachelor of Arts heading: Graphic Design, Digital Design, or Interaction Design

CIT also coordinates with the Udvar-Hazy School of Business in offering an emphasis within the Bachelor of Science in Business Administration program: Management Information Systems.

Certificates are also available for those interested in verifying specific sets of skills before completing their degree.

The fields housed within the Computing and Design department are diverse, exciting, rapidly changing, and ever expanding. These DSU programs offer students the opportunity to be challenged in small, personalized classes, where they can develop their knowledge and skills to be successful.

What is the Study of CIT?
To compete in a 21st century digital economy, every organization needs knowledgeable, technologically-savvy professionals.

The Dixie State University CIT Department specializes in providing a state-of-the-art education in advanced computer literacy, networking, operating systems, software applications, graphic design, programming, internet and web publishing, e-commerce, and related technology-oriented training.

Meet with an advisor in the department today to learn more about each of our degrees and which would fit your goals best.

Course Prefixes
- CIT, CS, DES, IT, WEB

ACM Club
Dixie State University’s Association of Computing Machinery (ACM) Club, also known as the Computer Club, provides computer enthusiasts a place to meet, form friendships, share ideas and play computer games. Within the ACM Club are housed a general computing branch, information security branch, and women in computing branch. Meeting dates and times vary. Contact the advisor for the branch that you are interested in. Don't hesitate to participate in multiple branches!
Be on the lookout for events each semester to participate in including the International Programming Contest in the fall and the ACM Programming Competition in the spring.

**Degrees & Certificates**

**Bachelor’s Degrees**

- Bachelor of Science in Computer Science (catalog.dixie.edu/programs/computerinformationtechnology/bachelor_of_science_in_computer_science)
- Bachelor of Science in Computer & Information Technology (catalog.dixie.edu/programs/computerinformationtechnology/bachelor_of_science_in_computer_information_technology)
- Bachelor of Science in Computer & Information Technology – Information Technology Emphasis (catalog.dixie.edu/programs/computerinformationtechnology/bachelor_of_science_in_computer_information_technology_information_technology_emphasis)
- Bachelor of Science in Computer & Information Technology – Software Development Emphasis (catalog.dixie.edu/programs/computerinformationtechnology/bachelor_of_science_in_computer_information_technology_computer_science_emphasis)
- Bachelor of Science in Computer & Information Technology – Web Design & Development Emphasis (catalog.dixie.edu/programs/computerinformationtechnology/bachelor_of_science_in_computer_information_technology_web_design_emphasis)
- Bachelor of Arts/Science in Design - Digital Design Emphasis (catalog.dixie.edu/programs/computerinformationtechnology/bachelor_of_science_in_design_digital_design_emphasis)
- Bachelor of Arts/Science in Design - Graphic Design Emphasis (catalog.dixie.edu/programs/computerinformationtechnology/bachelor_of_science_in_design_graphicDesign_emphasis)
- Bachelor of Arts/Science in Design - Interaction Design Emphasis (catalog.dixie.edu/programs/computerinformationtechnology/bachelor_of_science_in_design_interactionDesign_emphasis)
- Bachelor of Arts/Science in Integrated Studies - Digital Design Emphasis (catalog.dixie.edu/programs/interdisciplinaryartsandsciences/bachelor_of_arts_in_integrated_studies_digital_design)
- Bachelor of Arts/Science in Integrated Studies - Information Technology Emphasis (catalog.dixie.edu/programs/interdisciplinaryartsandsciences/bachelor_of_arts_in_integrated_studies_information_technology_emphasis)
- Bachelor of Arts/Science in Integrated Studies - Software Development Emphasis (catalog.dixie.edu/programs/interdisciplinaryartsandsciences/bachelor_of_arts_in_integrated_studies_computer_science_emphasis)
- Bachelor of Arts/Science in Integrated Studies - Web Design & Development Emphasis (catalog.dixie.edu/programs/interdisciplinaryartsandsciences/bachelor_of_arts_in_integrated_studies_webDesign_development)

**Minors**

- Minor in Computer Science (catalog.dixie.edu/programs/minor_in_computer_science)
- Minor in Digital Design (catalog.dixie.edu/programs/minor_in_digital_design)
- Minor in Information Technology (catalog.dixie.edu/programs/minor_in_information_technology)
- Minor in Web Design & Development (catalog.dixie.edu/programs/minor_in_web_design_development)

**Certificates**

- Visual Technologies Certificate (catalog.dixie.edu/programs/computerinformationtechnology/visual_technologies_certificate)

**Admission Requirements**

Incoming students will be placed in pre-program designations CIT-P or CS-P until they have completed the requirements below with a 2.5 or higher GPA. When students have completed the program admission requirements, they will meet with a CIT advisor to be officially accepted into the program.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 1400</td>
<td>Fundamentals of Programming</td>
<td>3</td>
</tr>
<tr>
<td>CS 1410</td>
<td>Object Oriented Programming</td>
<td>3</td>
</tr>
<tr>
<td>DES 1300</td>
<td>Design I</td>
<td>3</td>
</tr>
<tr>
<td>IT 1100</td>
<td>Introduction to Unix/Linux</td>
<td>3</td>
</tr>
<tr>
<td>MATH 1050</td>
<td>College Algebra / Pre-Calculus (MA) (or higher GE MATH course)</td>
<td>4</td>
</tr>
<tr>
<td>WEB 1400</td>
<td>Web Design I: Fundamentals</td>
<td>3</td>
</tr>
</tbody>
</table>
**Bachelor of Science in Computer & Information Technology - Information Technology Emphasis**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 1400</td>
<td>Fundamentals of Programming</td>
<td>3</td>
</tr>
<tr>
<td>CS 1410</td>
<td>Object Oriented Programming</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 1100</td>
<td>Business Calculus (MA)</td>
<td></td>
</tr>
<tr>
<td>IT 1100</td>
<td>Introduction to Unix/Linux</td>
<td>3</td>
</tr>
<tr>
<td>IT 1200</td>
<td>A+ Computer Hardware/Windows OS</td>
<td>3</td>
</tr>
<tr>
<td>IT 2400</td>
<td>Intro to Networking</td>
<td>3</td>
</tr>
<tr>
<td>WEB 1400</td>
<td>Web Design I: Fundamentals</td>
<td>3</td>
</tr>
</tbody>
</table>

**Bachelor of Science in Computer & Information Technology - Software Development Emphasis**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 1400</td>
<td>Fundamentals of Programming</td>
<td>3</td>
</tr>
<tr>
<td>CS 1410</td>
<td>Object Oriented Programming</td>
<td>3</td>
</tr>
<tr>
<td>CS 2420</td>
<td>Introduction to Algorithms and Data Structures</td>
<td>3</td>
</tr>
<tr>
<td>IT 1100</td>
<td>Introduction to Unix/Linux</td>
<td>3</td>
</tr>
<tr>
<td>MATH 1060</td>
<td>Trigonometry (MA) (or higher GE MATH course)</td>
<td>3</td>
</tr>
<tr>
<td>WEB 1400</td>
<td>Web Design I: Fundamentals</td>
<td>3</td>
</tr>
</tbody>
</table>

**Bachelor of Science in Computer & Information Technology - Web Design & Development Emphasis**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 1400</td>
<td>Fundamentals of Programming</td>
<td>3</td>
</tr>
<tr>
<td>DES 1300</td>
<td>Design I</td>
<td>3</td>
</tr>
<tr>
<td>IT 1100</td>
<td>Introduction to Unix/Linux</td>
<td>3</td>
</tr>
<tr>
<td>WEB 1400</td>
<td>Web Design I: Fundamentals</td>
<td>3</td>
</tr>
</tbody>
</table>

**Bachelor of Science in Computer Science**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 1400</td>
<td>Fundamentals of Programming</td>
<td>3</td>
</tr>
<tr>
<td>CS 1410</td>
<td>Object Oriented Programming</td>
<td>3</td>
</tr>
<tr>
<td>CS 2420</td>
<td>Introduction to Algorithms and Data Structures</td>
<td>3</td>
</tr>
<tr>
<td>MATH 1210</td>
<td>Calculus I (MA) (or higher GE MATH course)</td>
<td>4</td>
</tr>
</tbody>
</table>

**CIT Career Information**

**Career Strategies**

In addition to the required coursework in CIT, students can do the following to enhance their career opportunities:

- Develop strong interpersonal, communication and teamwork skills
- Patience and perseverance are essential for computer science professionals
- Obtain an internship; related experience is valuable
- Expect to work extended and/or irregular hours at times
- Prepare to learn new information on a regular basis through online discussions, classes, conferences, periodicals, and update your skills accordingly
- Obtain vendor-specific or networking certifications to gain a competitive edge for some positions

**Career Opportunities**

Careers will vary according to the course of study but can include:

- Network Engineers
- Database Administrators
- Computer Security Specialists
- Web Developers
- Software Engineers
- Computer Security Specialists
- Graphic Designers
- Multimedia Artists
- Animators
- Software Developers
Job Outlook
The overall employment projections from 2014 to 2024 show CIT will increase by 12%, a significantly faster pace than the average for all occupations.

Salary Range
The median wage for computer and information technology occupations was $81,430 in May 2015.

Computer Science Career Information

Career Strategies
In addition to the required coursework in computer science, students can do the following to enhance their career opportunities:

- Develop strong interpersonal, communication and teamwork skills.
- Develop patience and perseverance.
- Obtain an internship. Related experience is helpful.
- Prepare to learn new information on a regular basis through online discussions, classes, conferences, periodicals, etc.

Career Opportunities
The Computer Science degree at Dixie State University is designed to meet the national Accreditation Board for Engineering and Technology (ABET) accreditation standards. The CS degree will also prepare students for advanced degrees.

Demand for computer software engineers will increase as computer networking continues to grow. For example, expanding internet technologies have spurred demand for computer software engineers who can develop Internet, intranet, and World Wide Web applications. Likewise, electronic data-processing systems in business, telecommunications, healthcare, government, and other settings continue to become more sophisticated and complex. Implementing, safeguarding, and updating computer systems and resolving problems will fuel the demand for growing numbers of systems software engineers.

Some of the jobs in this area include:

- Computer Scientists
- Software Engineers
- Computer Programmers
- Computer Security Specialists
- Web Developers
- Software Developers

Job Outlook
Employment of software developers is projected to grow much faster than the average for all occupations, increasing by 17% from 2014 to 2024. Job prospects will be best for applicants with a bachelor's or higher degree and relevant experience.

Salary Range
As of May 2015, the median wage for software developers is $100,690, and that of computer programmers is $79,530.


Computer Information Tech Courses

CIT 1001. FYE: Computer & Information Technology. 1 Hour.
First Year Experience seminar course designed to help freshman students interested in computing adapt to college life and become integrated into Dixie State University and the Computer and Information Technology department. Students will refine academic skills, create and foster social networks, learn about college resources, explore the different options available within the CIT department, and learn about career opportunities in Computing. Multiple listed with all other sections of First Year Experience (all 1001 courses, ENGR 1000). Students may only take one FYE course for credit. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Understand the university support system by identifying and using campus resources. 2. Explore different majors. 3. Develop college survival skills. 4. Learn how to construct a graduation plan. FA, SP.
Computer Science Courses

CS 1030. Problem Solving with Computers. 3 Hours.
For any student interested in how computers are used to solve problems. This course will introduce the use of computers in problem solving including problem decomposition and algorithm construction. Students will be required to complete simple programming projects. Offered based upon sufficient student need. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Read and write small computer programs and a simple web page. 2. Communicate through discussion and writing about data and its effect on daily life. 3. Work with peers in creating, writing, and evaluating computer programs. Course fee required.

CS 1400. Fundamentals of Programming. 3 Hours.
Required of all students pursuing Computer and Information Technology degrees. Open to all students with a general interest in computer programming. Covers structured programming techniques and the syntax of a high level programming language through completion of programming projects of increasing difficulty. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Read and write small computer programs. 2. Use language components such as variables, conditionals, and lists. 3. Decompose small problems. Course fee required. FA, SP, SU.

CS 1410. Object Oriented Programming. 3 Hours.
Required of all students pursuing Computer and Information Technology degrees, open to all students with a general interest in computer programming. Introduces object oriented programming techniques through completion of programming projects of increasing difficulty. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Understand the basic elements of a programming environment (libraries and modules, editors, interpreters and compilers, on-line help, etc.). 2. Use fundamental programming constructs: control structures, functions, I/O (simple keyboard input and screen output and file input and output), classes and objects, and data collections. 3. Design and implement programs from English descriptions. 4. Understand and use the syntax of a high level programming language. Course fee required. Prerequisite: CS 1400 (Grade C- or higher). FA, SP.

CS 2420. Introduction to Algorithms and Data Structures. 3 Hours.
Required of students pursuing a Computer Science or Information Technology degree or emphasis, open to any student with a strong interest in computer programming. Covers the design and use of common data structures, lists, stacks, queues, trees, hash tables, and graphs through completion of several challenging programming projects. Introduces computational complexity and algorithm analysis. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Discuss the basic principles of many software data structures, including efficiencies and tradeoffs. 2. Implement and use several data structures, including Binary Search Trees, Hash Tables, and Graphs. 3. Demonstrate a working knowledge of Big-O complexity. 4. Demonstrate a working knowledge of Algorithm Analysis. 5. Parse mathematical expressions into a functioning graphics calculator. 6. Implement several recursive algorithms. 7. Implement and analyze several sorting algorithms. Course fee required. Prerequisite: CS 1410 (Grade C- or higher). FA, SP.

CS 2450. Software Engineering. 3 Hours.
Required of students pursuing a Computer Science degree or emphasis, open to any student with a strong interest in computer programming. Covers current software engineering theory and practice through completion of a challenging team project. Dual listed with MIS 4450 and WEB 3450 (students may take only one course for credit). **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Learn to manage IT projects. 2. Learn to work as a team. 3. Understand the software life cycle. 4. Gain experience in a larger scale software project. Course fee required. Prerequisite: CS 2420 (Grade C- or higher). FA, SP.

CS 2810. Computer Organization and Architecture. 3 Hours.
Required of students pursuing a Computer Science degree or emphasis, open to any student with a strong interest in computer programming. Covers digital hardware design and systems programming, including numeric representations, digital logic, processor architecture, instruction sets, assembly language, and other low-level programming topics. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Convert between number systems including binary, hexadecimal, octal, and decimal. 2. Debate and compare the design of computer instruction sets and assembly languages. 3. Compose low-level solutions to programming problems that interact directly with the operating system. 4. Generate structured assembly language solutions to algorithmic problems. Course fee required. Prerequisite: CS 1410 (Grade C- or higher). FA, SP.

CS 3005. Programming in C++. 3 Hours.
For student pursuing degrees in Computer Science and Computer and Information Technologies, or any student with a strong interest in computer programming. Covers syntax and semantics of C++ programming language through completion of hands-on projects. The student must already be fluent in some other programming language. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Construct computer programs in C++, using functions, classes and STL elements. 2. Construct computer programs using stack, heap and static memory. 3. Construct computer programs in a statically typed language. 4. Construct and use unit tests. 5. Use version control to manage code. 6. Use memory checking and debugging tools. 7. Create larger programs than in previous course work. Course fee required. Prerequisite: CS 1410 (Grade C- or higher). FA, SP.

CS 3010. Mobile Application Development for Android. 3 Hours.
For students pursuing degrees in Computer Science, or other students interested in writing applications for modern mobile devices using Google's Android operating system. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Develop modern applications for phones and tablets using the Android SDK and related tools. 2. Design and implement a functional graphical user interface suitable for a mobile application. 3. Understand the software architectural and design patterns necessary to develop sophisticated mobile applications. Course fee required. Prerequisites: CS 2420 (Grade C- or higher) AND CS 3005 (Grade C- or higher). SP.
CS 3020. Mobile Application Development: iOS. 3 Hours.
For students pursuing degrees in Computer Science, or other students interested in writing applications for modern mobile devices using Apple’s iOS operating system. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Develop modern applications for phones and tablets using the iOS SDK and related tools. 2. Design and implement a functional graphical user interface suitable for a mobile application. 3. Understand the software architectural and design patterns necessary to develop sophisticated mobile applications. Course fee required. Prerequisites: CS 2420 (Grade C- or higher); AND CS 3005 (Grade C- or higher). FA.

CS 3200. Web Application Development I. 3 Hours.
For students pursuing a degree in Computer Science or an emphasis in Software Development, or other students interested in writing applications for the modern web. Covers the fundamentals of three-tier web applications, including client-side code for modern browsers, server code using representative languages, and integration with database systems; also covers the protocols that connect these components and the environments which they run. Daul listed with WEB 3200. Students may only take one course for credit. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Develop modern web applications using both client-side and server-side languages and technologies. 2. Integrate database technologies into the ecosystem of a web application at a fundamental level. 3. Deploy the environments and infrastructure required by web application servers and related systems. 4. Understand the architectures, protocols and standards necessary to interconnect the client-side and server-side components. Course fee required. Prerequisites: CS 1410 (Grade C- or higher) AND WEB 1400 (Grade C- or higher); OR CS 2810 (Grade C- or higher). FA, SP.

CS 3310. Discrete Mathematics. 3 Hours.
For students pursuing degrees in Computer Science, or other students interested in counting theory and applications. Covers mathematical reasoning, combinatorial analysis, sets, permutations, relations, computational complexity, and Boolean logic through homework and programming assignments. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Learn to think logically. 2. Learn to solve complex problems by breaking them down. 3. Implement software related to discrete math topics. Course fee required. Prerequisite: MATH 1210 (Grade C- or higher); AND CS 1410 (Grade C- or higher). FA.

CS 3400. Operating Systems. 3 Hours.
Can be used to fulfill a requirement for students pursuing a degree or emphasis in Computer Science, and open to other students. Covers operating systems design and implementation, including processes and threads, synchronization, virtual memory, and file systems. Course taught by arrangement. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Design and implement software solutions that span multiple computers across a network. 2. Analyze the tradeoffs between competing goals in system software projects, including safety, performance, convenience, and ease of future maintenance. 3. Build and modify complex software projects in teams. 4. Assess and criticizing the design of modern and historical operating systems. Course fee required. Prerequisites: CS 2420 (Grade C- or higher); AND CS 3005 (Grade C- or higher); AND CS 2810 (Grade C- or higher). FA.

CS 3410. Distributed Systems. 3 Hours.
Can be used to fulfill a requirement for students pursuing a degree or emphasis in Computer Science, and open to other students. Covers design and implementation of network applications, including message passing, concurrency, synchronization, scalability, and partial failure. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Design and implement software solutions that span multiple computers across a network. 2. Analyze the tradeoffs between competing goals in system software projects, including safety, performance, convenience, and ease of future maintenance. 3. Build and modify complex software projects in teams. 4. Debate and differentiate the approaches and solutions to distributed systems problems taken by modern internet organizations. Course fee required. Prerequisites: CS 2420 (Grade C- or higher); AND CS 2810 (Grade C- or higher); AND CS 3005 (Grade C- or higher). SP.

CS 3440. Software Practices. 3 Hours.
For students pursuing degrees in Computer Science, or other students interested in gaining experience in software development practices. Covers practical usage of software development tools, source code control, software debugging, third party libraries and frameworks, and effective team work. Course fee required. Prerequisite: CS 3005 (Grade C- or higher). SP.

CS 3500. Application Development. 3 Hours.
For students pursuing degrees in Computer Science or Computer Information Technology, or others with an interest in graphical interface design and implementation. Covers the theory and practice of constructing easy to use interfaces through programming graphical environment projects in a variety of languages and platforms. Course taught by arrangement. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Develop GUI software in a variety of environments. 2. Be proficient in a variety of software development environments that are relevant to our local economy. Course fee required. Prerequisite: CS 3005 (Grade C- or higher). SP.

CS 3510. Advanced Algorithms/Data Structures. 3 Hours.
Required of students pursuing a Computer Science degree or emphasis. Covers the analysis and design of algorithms and data structures, including graphs, greedy algorithms, divide and conquer algorithms, and dynamic programming. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Analyze algorithms. 2. Divide-and-conquer algorithms. 3. Graph algorithms. 4. Dynamic programming. 5. Linear programming. 6. Analyze algorithm run time. 7. Find and solve recurrence relations. 8. Create and analyze divide-and-conquer, graph, dynamic programming and linear programming algorithms. 9. Choose suitable algorithms for problems. Course fee required. Prerequisites: CS 2420 (Grade C- or higher); AND CS 2810 (Grade C- or higher); AND CS 3310 (Grade C- or higher). SP.
CS 3520. Programming Languages. 3 Hours.
Required of students pursuing a Computer Science degree or emphasis. Covers the principles and concepts that characterize high-level computer programming languages, including function and data abstraction, and imperative, functional, logic and object-oriented programming techniques. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Compare major programming paradigms and appraising the impact each has on how programming problems are solved. 2. Differentiate between syntax and the underlying semantics that make up modern and historical languages. 3. Compose and construct software solutions from a wide range of fundamental language constructs. 4. Assess new languages as they emerge and determining their suitability for practical programming projects. Course fee required. Prerequisites: CS 2420 (Grade C- or higher); AND CS 2810 (Grade C- or higher). FA.

CS 3530. Computational Theory. 3 Hours.
Required of students pursuing a Computer Science degree or emphasis. Covers the theory of computation, including finite-state automata, pushdown automata, Turing machines, and equivalent formalisms. Also introduces complexity theory. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Compare the capabilities of various computational models and formulating new models as needed to research new classes of problems. 2. Analyze formal systems with mathematical rigor and the appropriate formal notation. 3. Investigate computational problems and categorizing their algorithmic complexity. 4. Appraise and justify the limits of computational models and the real-world systems that rely on them. Course fee required. Prerequisites: CS 2420 (Grade C- or higher); AND CS 2810 (Grade C- or higher); AND CS 3310 (can be concurrently enrolled). FA.

CS 3600. Graphics Programming. 3 Hours.
Required of students pursuing a Computer Science degree or emphasis, and open to other interested students. Covers 2-D and 3-D model creation, transformation, and various rendering techniques through completion of programming assignments. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Learn the syntax and use of an appropriate graphics API such as OpenGL. 2. Learn raster display concepts, input and output device management, human and camera visual systems, and a computer visual system. 3. Learn about frame buffers, pixel manipulation, lines, circles, text, and other basic primitives. 4. Learn how an RGB color display physically works, and how to program it as desired. 5. Learn viewing transformation, modeling transformation, and the Graphics Pipeline. 6. Learn to program the mouse and keyboard to respond appropriately to user input. 7. Learn modeling, rendering and animation techniques. 8. Learn the 3D Phong shading model. 9. Learn other graphics techniques such as hidden surface removal, texture mapping, and antialiasing. 10. Be briefly introduced to Curve and Surface modeling. 11. Be briefly introduced to Ray Tracing. 12. Be briefly introduced to Physically Based Modeling. 13. Be briefly introduced to Fractals. 14. Create several 2D and 3D graphics applications. Course fee required. Prerequisites: CS 2420 (Grade C- or higher); AND CS 2810 (Grade C- or higher); and CS 3310 (can be concurrently enrolled). SP.

CS 4200. Web Application Development II. 3 Hours.
For students interested in writing applications for the modern web. Covers advanced concepts and topics in client-side and server-side web application development. Students will be introduced to a variety of modern software frameworks, languages, architectural patterns, and techniques in order to create interactive, data-centric web applications. Course is dual listed with WEB 4200. Students may only take one course for credit. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Develop modern web applications using both client-side and server-side languages and technologies. 2. Assess the makeup of various client-side and server-side web application frameworks and their constituent components. 3. Create an interactive user experience using a client-side framework and interaction with a web service. 4. Understand the architectural and design patterns used by web application frameworks, and how they are used to produce maintainable and scalable web applications. Course fee required. Prerequisite: CS 3200 (Grade C- or higher). SP.

CS 4300. Artificial Intelligence. 3 Hours.
Required of students pursuing a Computer Science degree or emphasis. Introduces the broad field of artificial intelligence in computer software followed by specific applications in computer gaming strategies. Students will complete programming assignments. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Design problem definitions suitable for use in search algorithms. 2. Implement and use search algorithms. 3. Design and implement propositional logic to solve problems. 4. Design and implement Bayesian networks to solve problems. 5. Implement large software projects using third party libraries. 6. Work in large software projects. Course fee required. Prerequisites: CS 2420 (Grade C- or higher); AND CS 2810 (Grade C- or higher); AND CS 3005 (Grade C- or higher). SP.

CS 4307. Database Design & Management. 3 Hours.
Required of students pursuing a Computer Science degree or emphasis. Covers administration of database management systems, logical database design, implementation of database designs, and application development using a DBMS. Students will design, manage, and implement databases and applications that use databases. Dual listed with IT 4300 (students may take only one course for credit). **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Effectively design a database system. 2. Understand normal forms. 3. Understand the SQL language. Course fee required. Prerequisite: CS 1410 (can be concurrently enrolled). FA, SP.

CS 4310. Database Administration. 3 Hours.
This course covers the database architecture and environment. Students will be able to manage user access control. Students will be able to perform backup, restore, and recovery operations. Students will be able control performance and optimization issues. It covers updating and upgrading of a database system. Students will be able to perform the importing and exporting of data to/from a database. Dual listed with IT 4310 (only one course may be taken for credit). **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Manage and organize data into a database. 2. Backup and restore a database. 3. Tune a database for better performance performance. 4. Import/export data to and from a database. Course fee required. Prerequisite: CS 4307 (Grade C- or higher). FA.
CS 4550. Compilers. 3 Hours.
Required of students pursuing a Computer Science degree or emphasis. Covers compiler design and implementation, including lexical analysis, parsing, symbol table management, and generating code through challenging programming assignments. **COURSE LEARNING OUTCOMES (CLOs)
At the successful conclusion of this course, students will be able to: 1. Be further exposed to computer science theory, including Languages, Grammars, and Machines. 2. Study and implement Scanning and Lexical analysis. 3. Study and implement Parsing. 4. Study and implement an Interpreter. 5. Study and implement Machine Code Generation on a modern CPU. 6. Study and implement a Storage and Symbol Management system. 7. Review the intricacies of C++. 8. Implement a very large project using correct Software Engineering principles. Course fee required. Prerequisites: CS 2420 (Grade C- or higher); AND CS 2810 (Grade C- or higher); AND CS 3005 (Grade C- or higher). SP.

CS 4600. Senior Project. 3 Hours.
Required of students pursuing a Computer Science degree or emphasis. Students will complete an aggressive programming project of software engineering. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Have practical experience in project specification. 2. Have practical experience in project design. 3. Have practical experience in project implementation. 4. Have practical experience in project testing. Course fee required. Prerequisite: Senior status. SP.

CS 4920R. Internship. 1-3 Hours.
Internship course in Computer Science and Software Development. Variable credit 1.0 - 3.0. Repeatable up to 3 credits subject to graduation restrictions. Offered by arrangement. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Design and implement programming solutions to meet user needs. 2. Use current software development tools and techniques. 3. Develop software in a team environment. 4. Work with an employer. Course fee required. Prerequisites: CS 2420 (Grade C- or higher); AND CS 2810 (Grade C- or higher); AND CS 3005 (Grade C- of higher); AND instructor permission.

CS 4990. Sem in Computer Science. 3 Hours.
For students wishing instruction that is not available through other regularly scheduled courses in this discipline. Occasionally, either students need some type of non-traditional instruction, or an unanticipated opportunity for instruction presents itself. This course may include standard lectures, travel and field trips, guest speakers, laboratory exercises, or other nontraditional instruction methods. Repeatable for credit as topics vary, up to 6 credits. Course fee required. Prerequisite: Advanced standing. Offered by arrangement.

CS 4991R. Competitive Programming. 0.5 Hours.
For students interested in competing in programming contests. Covers problem analysis and classification, and efficient implementation of solutions. Repeatable up to 6 times for 3 credits. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Effectively compete in programming competitions. Prerequisite: CS 1400 (Grade C- or higher). FA, SP.

CS 4992. Seminar in Computer Science. 0.5-3 Hours.
For students wishing instruction that is not available through other regularly scheduled courses in this discipline. Occasionally, either students request some type of non-traditional instruction, or an unanticipated opportunity for instruction presents itself. This seminar course provides a variable credit context for these purposes. As requirements, this seminar course must first be pre-approved by the department chair; second, it must provide at least nine contact hours of lab or lecture for each credit offered; and third, it must include some academic project or paper (i.e., credit is not given for attendance alone). This course may include standard lectures, travel and field trips, guest speakers, laboratory exercises, or other nontraditional instruction methods. Note that this course in an elective and does not fulfill general education or program requirements. Fees may be required for some seminar courses and instructor permission will be optional at the request of the instructor.

Digital Design Courses

DES 1100. Intro to Digital Design. 3 Hours.
Introduces software and principles related to digital design and visual communications, and the creation and reproduction of art. Teaches how to create and modify digital images, illustration, and page layout using current design software and printing techniques. **COURSE LEARNING OUTCOMES (CLOs)
At the successful conclusion of this course, students will be able to: 1. Define graphic communications. 2. Define printing and identify products produced by printing. 3. Explain basic printing technologies. 4. Understand the design process. 5. Define the principles and elements of design. 6. Identify typeface classifications. 7. Understand point size, leading and alignment. 8. Understand software types and related applications. 9. List file types, file formats, and image types. 10. Create a PDF. 11. Create a page layout. 12. Students will be able to understand and demonstrate digital image editing. 13. Define pixels and resolution. 14. Understand the advantages & disadvantages of raster images. 15. Acquire a raster image. 16. Edit a raster image. 17. List the advantages & disadvantages of vector images. 18. Select and modify a vector image. 19. Create a vector image. Course fee required.

DES 1300. Design I. 3 Hours.
Explores the elements of design from which advertising, computer graphics, and graphic arts are structured by building awareness and skill in creating designs, using the concepts of composition, proportion, alignment, contrasts, white space, typography, eye movement, and element control, emphasizing the value of these concepts to communicate ideas. Course fee required. FA, SP.

DES 1610. Screen Printing. 3 Hours.
For students interested in the screen printing industry on the commercial level. Includes hands-on experiences for printing on various substrates using photographically/mechanically generated stencils, reproducing images with computers for positive reproduction, and multi-color screen printing on fabric. Instruction includes the use of vector image editing software. Offered based upon sufficient student need.
DES 2100. Design Thinking. 3 Hours.
An introduction to design thinking, an empathy-based, human-centered, and rapid prototype-driven methodology for innovation. Students will explore challenges such as the creation of new products, technological innovation, services, business models, experiences, processes and/or systems through the design thinking process. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Understand what is design thinking. 2. Understand the differences between design thinking and conventional problem solving. 3. Learn the design thinking process and the various tools, techniques and templates used in design thinking. 4. Apply the tools taught unto real life environment and situations. 5. Uncover unmet needs, unarticulated needs and undreamt needs. 6. Students will be able to examine critical theories of design, systems thinking, and design methodologies. 7. Students will be able to demonstrate sound thinking, creative inquiry, and diverse modes of reasoning-visual, perceptual, conceptual, inductive, deductive, analytical, logical, critical, organizational, and creative-through discussion and writing. 8. Students will be able to solve problems and address social concerns with innovative approaches to design and exploratory methodologies. Course fee required. FA, SP.

DES 2300. Design II. 3 Hours.
An intermediate level course that expands the skills and knowledge acquired in Design I. The course emphasizes practical assignments that examine applied problem solving and professional solutions for graphic designers. Specific themes/topics for the course include visual grouping and hierarchy, visual identity development and application of Gestalt theory. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Think creatively from the expression of an idea to the completion of a design. 2. Apply design fundamentals successfully. 3. Demonstrate an awareness of the history and context of design in relation to contemporary topics and social, political and cultural issues. 4. Communicate an understanding for the use of an design for expression. 5. Communicate and apply technical proficiency in areas appropriate as a designer to produce a cohesive body of work. Course fee required. Prerequisites: DES 1100 (Grade C or higher) OR WEB 1400 (Grade C or higher); AND DES 1300 (Grade C or higher) OR ART 1120 (Grade C or higher). FA, SP.

DES 2710. Typography I. 3 Hours.
Study of basic layout, lettering, type design, identification of styles, and typographic history. Students learn how to use type as a basic element of graphic communication, how the use of different typefaces visually communicate a desired effect, and fundamental terminology of type specification. Consists of lectures, quizzes, and ongoing typographically-related projects intended to be of portfolio-quality. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Follow direction and meet deadlines. 2. Demonstrate an understanding of the use of type in the finished project. 3. Present work in a professional manner and to give and receive feedback during critiques. 4. Have competency in craftsmanship, creativity, in while using the appropriate design principles. 5. Have an understanding of the basic history and evolution of type. 6. Name the basic anatomy of type; x-height, baseline, descender, apex, etc. 7. Demonstrate an understanding of the use of typefaces. 8. Know the how typefaces are classified based on their visual properties. 9. Choose appropriate typefaces for projects i.e., web vs print. 10. Demonstrate an understanding of visual hierarchy in relation to type. 11. Demonstrate an understanding of visual hierarchy in relation to type. 12. Demonstrate an understanding of visual hierarchy in relation to type. 13. Set tabs, margins, style sheets and other type functions in InDesign and Illustrator. Course fee required. Prerequisite: ART 1120 OR DES 1300 (Grade C or higher). FA, SP.

DES 3000. Design III. 3 Hours.
Advanced application of design theory and processes, conceptual thinking and expansive form-making. Students will continue to develop their unique design voice and process, through further exploration of typography, imagery, and visual continuity to create complex portfolio-ready work. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Acquire and demonstrate fluency in the visual vocabulary and technical skills relevant to design. 2. Demonstrate the ability to analyze, synthesize, and develop probable solutions. 3. Successfully present project processes and outcomes through both written and oral communication. 4. Combine excellent craft skills with strong conceptual abilities. 5. Produce a portfolio of work that meets employer and marketplace expectations. Course fee required. Prerequisites: ART 1110 (Grade C or higher); AND DES 2300 (Grade C or higher); AND DES 2710 (Grade C or higher); AND ART 2060 (Grade C or higher). SP.

DES 3300. Intro to Digital Video Editing. 3 Hours.
For students pursuing a degree in Computer and Information Technology. Introduces essentials of editing video and audio with computers, including TV/video production applications, multimedia authoring, and/or Internet video streaming. Also includes digitizing video and audio from analogue or digital sources, selecting footage from source clips, constructing transitions, titling, creating and using alpha channel or other matte techniques, plus other special effects. Course fee required. Prerequisites: DES 2300 (Grade C- or higher); AND DES 2600 (Grade C- or higher). SP.

DES 3400. Information Design. 3 Hours.
Introduction to the field of information design, data visualization, infographics and instructional materials. Students will explore information design problems in both stand-alone and system applications; digital (interaction) media, print, and environmental communication. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Develop a deep understanding of visual organization and information design. 2. Develop skills to analyze and design effective data visualizations and communication. 3. Learn to develop a visual narrative through the design process. 4. Understand the implications that information design skills hold for design management in the distillation of multivariate data. Demonstrate ability to create impactful and relevant data visualizations and information graphics. Course fee required. Prerequisites: DES 2710 (Grade C or higher). SP.
**DES 3500. Interface Design. 3 Hours.**
Students will learn a user-centered approach and process to design interfaces for web, mobile and software applications successfully. Exploration of grid structures, layouts, signs and symbols, branding, and typography as they relate to interface design. **COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Demonstrate an understanding of the design process as it relates to User Interface design through iterative, user-centered design practices and implementations. 2. Demonstrate proficiency in the evaluation, presentation, design, and delivery of a successful User Interface. 3. Demonstrate use of appropriate layout, typography, color and visual hierarchy for User Interface design. 4. Demonstrate the ability to analyze, synthesize, and develop probable solutions. 5. Combine excellent craft skills with strong conceptual abilities. 6. Effectively collaborate on projects while working in teams. Course fee required. Prerequisites: WEB 1400 (Grade C or higher); AND DES 2300 (Grade C or higher); AND DES 2710 (Grade C or higher). SP.

**DES 3600. 3-D Visualization. 3 Hours.**
Introduces three-dimensional modeling and rendering techniques on the computer, including various modeling processes, defining and applying textures, assembling scenes, and rendering images, which are applicable to realistic package and product designs, motion picture pictures, video game assets, as well as graphics for desktop or Internet publishing projects. Course fee required. Prerequisites: DES 2300 (Grade C or higher); AND DES 2710 (Grade C or higher). SP.

**DES 3650. 3-D Animation. 3 Hours.**
For students pursuing a degree in Computer and Information Technology. Companion course to DES 3600, covers aspects of 3D animation design, story boarding, character development, and animation rendering of 3D models suitable for broadcast or composite video use. Maya 3D software will be used to create multiple short animation projects individually and in teams. Includes rigid/soft body animation solvers, dynamic particles, deformation and effects fields, IK/FK rigging, and multi-frame rendering output, use of key frames, ease in/ease out controls, the timeline, realistic modeling techniques, set lighting, shadows, multi-layer surfacing, photorealistic rendering, and video formats for final output. Dual listed with ART 3650 (students may only take one course for credit). Prerequisites: DES 3600 or ART 3610 (Grade C- or higher). SP.

**DES 3710. Typography II. 3 Hours.**
Covers typography as a functional and experimental medium and typeface design. Students develop typographic solutions that explore verbal/visual messages in designs for publication through design problem-solving for a diverse range of specifications, including audience, client needs, and budget constraints, using traditional and digital tools. Course fee required. Prerequisite: DES 2300 (Grade C or higher); AND DES 2710 (Grade C or higher). SP.

**DES 3780. Prepress & Print Production. 3 Hours.**
Overview of desktop publishing and digital imaging on the prepress industry. Topics include input and output, correct creation of digital files, data storage, proofing methods, and relevant terminology/communication with prepress and printing professionals. Also acquaints students with the variety of jobs offered in the field, file evaluation, and much more. Field trips to printers and other prepress service providers reinforce lectures/projects. Course fee required. Dual listed with ART 3780 (students may take only one course for credit). Prerequisite: DES 2300 (Grade C- or higher) and DES 2600 (Grade C- or higher). SP.

**DES 3800. Branding. 3 Hours.**
Explores the history, psychology and purpose of corporate identity programs and the role of communication design in the current corporate environment by analyzing, investigating, and reporting on current company corporate objectives and target markets and then designing a sound multifaceted identity program. Course fee required. Prerequisite: DES 2300 (Grade C or higher); AND DES 2710 (Grade C or higher). SP.

**DES 3850. Graphic Design Problems. 3 Hours.**
For students pursuing a Graphic Design degree or an emphasis in Digital Design; also open to other interested students. Students will develop critical thinking, research, and practical skills related the graphic design industry. Students solve design problems by designing for commercial media, self-promotion. Includes practical exercises in project management and other real-world applications. Course content changes by semester to reflect current trends and issues in the design industry. Course fee required. Prerequisites: DES 2100 (Grade C or higher); AND DES 2300 (Grade C or higher); AND DES 2710 (Grade C or higher). FA.

**DES 4100. Interaction Design. 3 Hours.**
Exploration of advanced User Interface and User Experience design. Students will learn how to use words, visual representations, objects or space, time and behavior to create successful interaction between a user and a product which enables the user to achieve their objective(s) in the best way possible. **COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Demonstrate the ability to analyze, synthesize, and develop probable solutions. 2. Learn the process of interaction design, including crafting user flows, site mapping, sketching, wireframing, prototyping, and creating mock-ups. 3. Perform user research, develop user stories, and implement user testing. 4. Create and evaluate interactive prototypes and/or high-fidelity prototypes. 5. Combine excellent craft skills with strong conceptual abilities. Course fee required. Prerequisites: DES 2100 (Grade C or higher); AND DES 3500 (Grade C or higher). SP.

**DES 4200. Tangible Interaction. 3 Hours.**
This course explores the use of tangible interaction in relationship to emerging technologies. Students will explore the how humans interact with technology while creating tangible objects that affect how we work, play, communicate and learn. **COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Demonstrate the ability to analyze, synthesize, and develop probable solutions. 2. Understand the process of planning and executing tangible interactive work. 3. Combine excellent craft skills with strong conceptual abilities. 4. Effectively collaborate on projects while working in teams. 5. Criticize and discuss tangible artifacts through low and high resolution prototypes. 6. Design, implement and communicate tangible interaction concepts. 7. Demonstrate practical and conceptual ways of utilizing tangible interaction. Course fee required. Prerequisites: CS 1400 (Grade C or higher); AND DES 2100 (Grade C or higher). FA.
Prerequisites: IT 1200 and IT 2400 (both Grade C- or higher). SP.

IT, Windows Roles, Workgroups, Active Directory, and Domain Management. File and printer sharing will also be discussed. Course fee required. Students will learn Windows server management techniques to support a small to medium-sized business. Topics covered will include DHCP, DNS, collection, and dissemination will also be covered. Course fee required. Prerequisite: IT 3100 (Grade C- or higher). SP.

Enhances student administrative skills by promoting use of programming structures to manipulate, configure, and maintain systems. Image creation, environment. Course fee required. Prerequisites: CS 1400 (Grade C- or higher); AND IT 2400 (Grade C- or higher). FA.

Required of Computer and Information Technology majors and students with an emphasis in Information Technology. Covers system administration topics for managing Internet facing services, including DNS, SMTP, and HTTP. Students will install, configure, and test services in a server environment. Course fee required. Prerequisites: CS 1400 (Grade C- or higher); AND IT 2400 (Grade C- or higher). FA.

Enhances student administrative skills by promoting use of programming structures to manipulate, configure, and maintain systems. Image creation, collection, and dissemination will also be covered. Course fee required. Prerequisite: IT 3100 (Grade C- or higher). SP.

Students will learn Windows’s server management techniques to support a small to medium-sized business. Topics covered will include DHCP, DNS, IT, Windows Roles, Workgroups, Active Directory, and Domain Management. File and printer sharing will also be discussed. Course fee required. Prerequisites: IT 1200 and IT 2400 (both Grade C- or higher). SP.
IT 3300. DevOps Virtualization. 3 Hours.
Full Operating System virtualization as well as container or application virtualization topics will be covered. Automated deployment using configuration files. Management topics such as load-balancing, auto-failover, and high availability will also be discussed. Prerequisite: IT 2400 (Grade C- or higher). FA.

IT 4060. Big Data Analytics. 3 Hours.
Course focuses on a theoretical and hands-on exploration of business intelligence and analytics. It covers current best practices in statistical and quantitative analysis using large-scale data sets, exploratory and predictive models, and evidence-based methods to improve business decisions and actions. Dual listed with ISA 4070 (students may only take one course for credit). Prerequisites: IT 4300 (Grade C- or higher); AND STAT 2040 OR MATH 1040 (Grade C- or higher). FA.

IT 4070. Big Data Visualization. 3 Hours.
A focus on the methods, tools and processes to effectively visually encode and present insights discovered from previously analyzed data. It includes practice transforming simple and complex data analysis outputs into relevant, accurate, and effective visual displays to improve communication and decision making. Dual listed with ISA 4070 (students may only take one course for credit). SP.

IT 4100. Files Systems and Storage Technologies. 3 Hours.
Classic, virtualized, and cloud storage will be covered. Topics such as RAID, NAS, SAN will be covered. Business continuity for backup and replication of storage. Local vs. Remote file systems. We will explore older and newer OS filesystems and compare them (such as fat32, ntfs, ext3, ext4, btrfs). Dual listed with CJ 4700 (students may only take one course for credit). Course fee required. Prerequisite: IT 3100 (Grade C- or higher). SP (even).

IT 4200. DevOps Lifecycle Management. 3 Hours.
Takes students through the DevOps lifecycle. Students will develop practical skills in continuous integration, cloud provisioning, configuration management, continuous deployment, continuous monitoring, and continuous feedback. Course fee required. Prerequisites: CS 1400 (Grade C- or higher) AND IT 2400 (Grade C- or higher) AND IT 4000 (Grade C- or higher). FA.

IT 4300. Database Design & Management. 3 Hours.
Required of students pursuing an Information Technology emphasis. Covers administration of database management systems, logical database design, implementation of database designs, and application development using a DBMS. Students will design, manage, and implement databases and applications that use databases. Dual listed with CS 4307 (students may take only one course for credit). Course fee required. Prerequisites: CS 1400 (Grade C- or higher) AND IT 1100 (Grade C- or higher). FA, SP.

IT 4310. Database Administration. 3 Hours.
This course covers the database architecture and environment. Students will be able to manage user access control. Students will be able to perform backup, restore, and recovery operations. Students will be able control performance and optimization issues. It covers updating and upgrading of a database system. Students will be able to perform the importing and exporting of data to/from a database. Dual listed with CS 4310 (only one course may be taken for credit). Prerequisites: IT 4300 (Grade C- or higher). FA

IT 4400. Network Design & Management. 3 Hours.
Required of students pursuing an Information Technology emphasis. Covers administration of network technologies, core network design, implementation of network designs, and application development using a NMS. Students will design, manage, and monitor the network. Hands-on configuration experience of layers 1, 2, and 3 will be given on both LAN and WAN levels. The successful student will be prepared to successfully complete the CCNA exam. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Create and assign subnets and vlans. 2. Manage Cisco Devices. 3. Manage a small network. 4. Explain and Implement different routing protocols. Course fee required. Prerequisite: IT 2400 (Grade C- or higher). FA.

IT 4500. Information Security. 3 Hours.
Required of students pursuing an Information Technology emphasis. Reviews current security exploits, vulnerabilities, and counter measures. Covers general security models and architectures, encryption and forensics. Course fee required. Prerequisites: CS 1400 (Grade C- or higher) AND IT 3100 (Grade C- or higher). SP.

IT 4510. Ethical Hacking & Network Defense. 3 Hours.
This course provides an in-depth, hands-on experience in effectively protect networks. Students will learn the tools and penetration testing methodologies used in ethical hacking. Additionally, cyber-ethics regarding piracy, intellectual property, and fair information practices will be discussed along with state, federal, and international laws governing information technology. Prerequisites: CS 1410 (Grade C- or higher) AND IT 2400 (Grade C- or higher). FA.

IT 4600. Senior Project. 3 Hours.
Required of students pursuing an Information Technology emphasis. Students will complete an aggressive information technology project. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Analyse requirements necessary for a project. 2. Plan how to solve a project. 3. Build and implement a project. Course fee required. Prerequisite: Senior status. SP.

IT 4920R. Internship. 1-3 Hours.
Internship course in Information Technology. Course fee required. Variable credit 1.0 - 3.0. Repeatable up to 3 credits subject to graduation restrictions. Prerequisite: Instructor permission. FA, SP, SU.
IT 4990. Seminar in Information Technology. 3 Hours.
For students wishing instruction that is not available through other regularly scheduled courses in this discipline. Occasionally, either students need some type of non-traditional instruction, or an unanticipated opportunity for instruction presents itself. This course may include standard lectures, travel and field trips, guest speakers, laboratory exercises, or other nontraditional instruction methods. Repeatable for credit as topics vary, up to 12 credits. Course fee required. Prerequisite: Advanced standing. Offered by arrangement.

IT 4991. Seminar in Information Technology. 0.5-3 Hours.
For students wishing instruction that is not available through other regularly scheduled courses in this discipline. Occasionally, either students request some type of non-traditional instruction, or an unanticipated opportunity for instruction presents itself. This seminar course provides a variable credit context for these purposes. As requirements, this seminar course must first be pre-approved by the department chair; second, it must provide at least nine contact hours of lab or lecture for each credit offered; and third, it must include some academic project or paper (i.e., credit is not given for attendance alone). This course may include standard lectures, travel and field trips, guest speakers, laboratory exercises, or other nontraditional instruction methods. Note that this course in an elective and does not fulfill general education or program requirements. Fees may be required for some seminar courses and instructor permission will be optional at the request of the instructor.

Web Design Development Courses

WEB 1400. Web Design I: Fundamentals. 3 Hours.
For students pursuing a degree in Computer and Information Technology. Covers fundamental principles of front-end web design, including beginner's hands-on experience with HTML and CSS in planning, organizing, analysis, and designing websites. Introduces key foundation concepts such as Internet infrastructure, web page creation and publishing, wire framing, layout techniques, multimedia, content, color, typography, and accessibility. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Understand the general workings of the Internet and infrastructure. 2. Use web authoring and design environment - tools, browsers, servers. 3. Apply current and past web markup & styling languages and their differences. 4. Learn careers within web design & development. 5. Apply the development process. 6. Use multimedia optimization and preparation. 7. Apply design principles to the web. 8. Apply user interaction and communication. Course fee required. FA, SP.

WEB 3200. Web Application Development I. 3 Hours.
For students pursuing an emphasis in Web Design & Development, or other students interested in writing applications for the modern web. Covers the fundamentals of three-tier web applications, including client-side code for modern browsers, server code using representative languages, and integration with database systems; also covers the protocols that connect these components and the environments in which they run. Dual listed with CS 3200 (students may only take one course for credit). **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Develop modern web applications using both client-side and server-side languages and technologies. 2. Integrate database technologies into the ecosystem of a web application at a fundamental level. 3. Deploy the environments and infrastructure required by web application servers and related systems. 4. Understand the architectures, protocols and standards necessary to interconnect the client-side and server-side components. Course fee required. Prerequisites: CS 1410 (Grade C- or higher); AND WEB 1400 (Grade C- or higher). FA, SP.

WEB 3400. Web Design II: Essentials. 3 Hours.
For students pursuing a degree in Computer and Information Technology. Covers intermediate concepts of front-end web design and development, including essential hands-on experience with HTML, CSS, JavaScript, and other web publishing tools. Essential concepts such as domain and hosting infrastructure, modern web design frameworks & libraries, user interface and experience, e-commerce, web promotion, legal models, development environments, and interactivity are all examined. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Use Internet infrastructure, hosting, and tools. 2. Apply current web markup, styling, and scripting languages, and supporting front-end web technologies. 3. Implement commercial web site development and team implementation strategies. 4. Design for web accessibility. 5. Apply basic backend development practices. 6. Communicate a message through a rich user interface and experience. 7. Design for various web environments. 8. Improve online web promotion. 9. Know current web security, legal, social, and professional issues. Course fee required. Prerequisites: DES 1300 (Grade C- or higher); AND WEB 1400 (Grade C- or higher). FA, SP.

WEB 3450. Software Engineering. 3 Hours.
Students will take on a challenging team project. Students will also learn about the software lifecycle and its phases. Dual listed with MIS 4450 & CS 2450 (students may take only one course for credit). **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Learn to manage IT projects. 2. Learn to work as a team. 3. Understand the software lifecycle. 4. Gain experience in a large scale software project. Course fee required. Prerequisites: WEB 3200 (Grade C- or higher); AND WEB 3400 (Grade C- or higher). FA, SP.
WEB 3500. Electronic Commerce. 3 Hours.
For students pursuing a Computer & Information Technology degree. Also open to other interested students. Covers concepts and principles of electronic commerce from an interdisciplinary approach, including computer sciences, marketing, consumer behavior, finance, economics, and information systems. Specifics include electronic commerce process steps, Internet infrastructure, demographics, marketing and market research, advertising, promotion, strategy development, financing, competitive analysis, technical development, Web site review, launch, and on-going innovation. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Demonstrate the ability to identify a problem, then analyze and prepare a solution essential to successful problem solving. 2. Exhibit the ability to synthesize multiple sources of information to solve problems, and use one’s experiences and other sources of information to create new insights and generate better problem solving approaches. 3. Demonstrate the ability to create, think, design, and/or build prototype solutions for problems or product ideas. 4. Facilitate the constant change of technology by fostering intellectual curiosity and the ability to access information from diverse sources as well as relating knowledge to daily life and defining issues within larger contexts. 5. Demonstrate an awareness and an understanding of these issues as the apply to technology entrepreneurship by articulating and integrating relevant ethical, legal, social, and technical concerns into their projects and exhibiting an openness to ideas different from or in conflict with one’s own, including assumptions, prejudices, and privileges. 6. Demonstrate the ability to function effectively in teams to accomplish stated goals. using advanced knowledge skills in problem solving positive work ethic, effective use of technology, and understanding team-centric workplace culture, improved social behavior and competent professional skills to obtain and maintain successful employment within an organization, business, or other entity. 7. Demonstrate convincing technical communications skills, both orally and in writing by exhibiting the ability to be a useful team member, capable of working in groups on strategic problems. 8. Apply and understand technology entrepreneurship process elements including (a) opportunity assessment, (b) market research, (c) competitive assessment, (d) strategy development, (e) finance development, (f) risk assessment, (g) technology development, (h) web review, (i) launch, and (j) ongoing innovation. Course fee required. FA, SP.

WEB 3550. Internet & eCommerce Marketing. 3 Hours.
For students pursuing a Computer & Information Technology degree. Also open to interested students. Covers impact of new technologies and Internet expansion on marketing and advertising information intensive products and services on the Internet, particularly targeting and reaching customers. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Implement Internet Marketing Strategies through PPC, social media, content curation, blogging, retargeting, video, reviews, subscription based, Search Engine Algorithms, Onsite and Offsite SEO, and emerging techniques. 2. Use industry standards and practices. 3. Analyze and track data to measure and quantify web traffic, goals, and conversions. Course fee required. FA, SP.

WEB 4200. Web Application Development II. 3 Hours.
For students pursuing an emphasis in Web Design & Development, or other students interested in writing applications for the modern web. Covers advanced concepts and topics in client-side and server-side web application development. Students will be introduced to a variety of modern software frameworks, languages, architectural patterns, and techniques in order to create interactive, data-centric web applications. Dual listed with CS 4200 (students may only take one course for credit). **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Develop modern web applications using both client-side and server-side languages and technologies. 2. Assess the makeup of various client-side and server-side web application frameworks and their constituent components. 3. Create an interactive user experience using a client-side framework and interaction with a web service. 4. Understand the architectural and design patterns used by web application frameworks, and how they are used to produce maintainable and scalable web applications. Course fee required. Prerequisite: WEB 3200 (Grade C- or higher). SP.

WEB 4400. Web Design III: Advanced Techniques. 3 Hours.
For students pursuing a degree in Computer and Information Technology. Covers mastery-level web design and development practices. Hands-on experience developed using advanced technologies such as HTML, CSS, JavaScript, content management systems, advanced web frameworks & libraries, and other advanced front-end technologies. In-depth web topics are covered including: advanced design techniques, user interface and experience, interactivity, animation, and other web related concepts are covered. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Develop, design, and implement industry standard & professional websites. 2. Create front end web scripting, styling, and structure. 3. Animate interactive web elements. 4. Develop various content manage systems. 5. Create user interface, experience, and interaction design in relation to the web. 6. Use current libraries & framework systems. Course fee required. Prerequisites: DES 3500 (Grade C- or higher); AND WEB 3400 (Grade C- or higher). FA.

WEB 4600. Senior Project. 3 Hours.
For students pursuing a degree in Computer and Information Technology. Emphasizes application of skills to commercial projects through design of or contribution to various private sector or university internet projects, print, and multimedia projects. Includes portfolio development. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Identify and plan a meaningful project, break down the project into workable items, and then attach timelines to project elements to ensure student/project work accountability. 2. Produce prototypes, designs, code, and user experiences as needed by the project or product or design using iterative processes and feedback to demonstrate continuous improvement overtime. 3. Identify and assemble necessary resources for the completion of project work. 4. Plan and implement all aspects of the instructor approved project. 5. Demonstrate the ability to function effectively in teams to accomplish stated goals. Students will demonstrate advanced knowledge skills in problem solving positive work ethic, effective use of technology, and understanding team-centric workplace culture. 6. Demonstrate convincing technical communications skills, both orally and in writing exhibiting the ability to be useful team members, capable of working in groups projects and also initiating self learning and independent work as is necessary for the approved project. 7. Demonstrate accountability and responsibility with development processes by submitting weekly project updates on hourly workload, meaningful project progress, iterative changes, new learning, and project challenges. Course fee required. Prerequisite: Senior standing. SP.
WEB 4900R. Independent Research. 1-3 Hours.
For students pursuing an emphasis in Web Design and Development with advanced standing who wish to pursue a specific focus of study related to their degree emphasis and/or research interest not otherwise available in the current Web Design and Development curriculum. Students are closely supervised by appropriate faculty in the design and successful completion of the course. The course is dependent upon a formal contractual arrangement with the faculty member that is submitted at the beginning of the semester in which coursework is undertaken, and is contingent upon the department chair’s approval. Students meet with the faculty mentor each week and provide progress reports for feedback. Students are required to meet the university requirement of 45 hours of work per credit. Variable credit 1.0 - 3.0. Repeatable up to 3 credits subject to graduation restrictions. Offered by arrangement. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Analyze and solve web problems within a development environment. 2. Research new topics and emerging areas of the industry. 3. Communicate findings and research to instructors. Course fee required. Prerequisite: Instructor permission.

WEB 4920. Internship. 3 Hours.
For students pursuing a degree in Computer and Information Technology. Designed to integrate Web Design & Development students into working environments that increase aptitude, skills, and networking. The internship setting will nurture a mentor learning relationship with the student, and assist them in preparation for after graduation. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Analyze and solve web problems from an employment environment. 2. Research new topics and emerging areas of the business. 3. Communicate findings and research to employers. Course fee required. Prerequisite: Instructor permission. FA, SP, SU.

WEB 4990. Seminar in Web Development. 3 Hours.
For students wishing instruction that is not available through other regularly scheduled courses in this discipline. Occasionally, either students need some type of non-traditional instruction, or an unanticipated opportunity for instruction presents itself. This course may include standard lectures, travel and field trips, guest speakers, laboratory exercises, or other nontraditional instruction methods. Repeatable for credit as topics vary, up to 6 credits. Course fee required. Prerequisite: Advanced standing. Offered by arrangement.