MASTER OF SCIENCE (M.S.)
MAJOR IN COMPUTER SCIENCE

Major Program
The programs in computer science are designed to prepare students for doctoral research, college teaching, careers in computer science and software engineering, and careers in digital forensics.

Application Requirements
The items listed below are required for admission consideration for applicable semesters of entry during the 2017-2018 academic year. Submission instructions, additional details, and changes to admission requirements for semesters other than the 2017-2018 academic year can be found on the program’s web page (http://gradcollege.txstate.edu/programs). International students should review the International Admission Documents (http://mycatalog.txstate.edu/graduate/admission-documents/international) section of the catalog for additional requirements.

- completed online ApplyTexas application
- $40 nonrefundable application fee
- $50 nonrefundable international evaluation fee (if applicable)
- baccalaureate degree from a regionally accredited university
- official transcripts required from each institution where course credit was granted
- minimum 2.75 GPA in your last 60 hours of undergraduate course work (plus any completed graduate courses)
- background course work*
- official GRE scores required with a preferred minimum of 286 (verbal and quantitative sections combined) with no less than 140 in the verbal section and 148 in the quantitative section
  - The GRE may be waived if you hold a master’s or doctoral degree from a regionally accredited U.S. institution. If you hold a master’s or doctoral degree (or the equivalent thereof) from an accredited international institution, the GRE may be waived on an individual basis.

- resume/CV
- statement of purpose
- three letters of recommendation

TOEFL or IELTS Scores
Non-native English speakers who do not qualify for an English proficiency waiver:

- official TOEFL iBT scores required with a 78 overall
- official IELTS (academic) scores required with a 6.5 overall and
  - minimum individual module scores of 5.5

*Additional Information
If you are accepted to the program, you will participate in a diagnostic interview with the graduate advisor. This interview will include a review of test scores, grades, and work history. In some cases, additional courses may be added to your degree program.

Degree Requirements
1. Thesis option (30-semester hour degree): Completion of 12 hours of graduate core courses, an additional 12 hours of graduate computer science electives, and completion of a thesis. The thesis must be accepted by a departmental supervisory committee of graduate faculty members, the department Chair, and the Dean of the Graduate College. The thesis program requires a minimum enrollment of 6 hours in CS 5399A and CS 5399B. Thesis credit requirement information is provided in the “Degree Information” thesis requirements section of the catalog. Students who select a minor may replace 6 graduate hours of computer science electives with 6 graduate hours of an approved minor.

2. Non-thesis option (36-semester hour degree): Completion of 12 hours of graduate core courses and an additional 24 hours of graduate computer science electives. Students who select a minor may replace 9 graduate hours of computer science electives with 9 graduate hours of an approved minor.

Course Requirements
Non-thesis Option with Science Minor

<table>
<thead>
<tr>
<th>Core</th>
<th></th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>CS 5329</td>
<td>Algorithm Design and Analysis</td>
</tr>
<tr>
<td>Group 2</td>
<td>CS 5346</td>
<td>Advanced Artificial Intelligence or CS 5391</td>
</tr>
<tr>
<td>Group 3 (Choose 3 hours)</td>
<td>CS 5306</td>
<td>Advanced Operating Systems</td>
</tr>
<tr>
<td></td>
<td>CS 5310</td>
<td>Network and Communication Systems</td>
</tr>
<tr>
<td></td>
<td>CS 5332</td>
<td>Data Base Theory and Design</td>
</tr>
<tr>
<td>Group 4 (Choose 3 hours)</td>
<td>CS 5318</td>
<td>Principles of Programming Languages</td>
</tr>
<tr>
<td></td>
<td>CS 5338</td>
<td>Formal Languages</td>
</tr>
<tr>
<td></td>
<td>CS 5351</td>
<td>Parallel Processing</td>
</tr>
</tbody>
</table>

Electives
Choose 15 hours of 5000-level CS course work

Minor
Choose 9-hour Science Minor

Total Hours 36

Thesis Option with Science Minor

<table>
<thead>
<tr>
<th>Core</th>
<th></th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>CS 5329</td>
<td>Algorithm Design and Analysis</td>
</tr>
<tr>
<td>Group 2</td>
<td>CS 5346</td>
<td>Advanced Artificial Intelligence or CS 5391</td>
</tr>
</tbody>
</table>
Master of Science (M.S.) Major in Computer Science

Group 3 (Choose 3 hours) 3
CS 5306 Advanced Operating Systems
CS 5310 Network and Communication Systems
CS 5332 Data Base Theory and Design

Group 4 (Choose 3 hours) 3
CS 5318 Principles of Programming Languages
CS 5338 Formal Languages
CS 5351 Parallel Processing

Electives
Choose 6 hours of 5000-level CS course work 6

Minor
Choose 6-hour Science Minor 6

Thesis
Choose a minimum 6 hours 6
CS 5199B Thesis
CS 5299B Thesis
CS 5399A Thesis
CS 5399B Thesis
CS 5999B Thesis

Total Hours 30

Non-thesis Option

Core

Group 1 3
CS 5329 Algorithm Design and Analysis

Group 2 3
CS 5346 Advanced Artificial Intelligence
or CS 5391 Survey of Software Engineering

Group 3 (Choose 3 hours) 3
CS 5306 Advanced Operating Systems
CS 5310 Network and Communication Systems
CS 5332 Data Base Theory and Design

Group 4 (Choose 3 hours) 3
CS 5318 Principles of Programming Languages
CS 5338 Formal Languages
CS 5351 Parallel Processing

Electives
Choose 24 hours of 5000-level CS course work 24

Total Hours 36

Thesis Option

Core

Group 1 3
CS 5329 Algorithm Design and Analysis

Group 2 3
CS 5346 Advanced Artificial Intelligence
or CS 5391 Survey of Software Engineering

Group 3 (Choose 3 hours) 3
CS 5306 Advanced Operating Systems
CS 5310 Network and Communication Systems
CS 5332 Data Base Theory and Design

Group 4 (Choose 3 hours) 3
CS 5318 Principles of Programming Languages
CS 5338 Formal Languages
CS 5351 Parallel Processing

Electives
Choose 12 hours of 5000-level CS course work 12

Thesis
Choose a minimum 6 hours 6
CS 5199B Thesis
CS 5299B Thesis
CS 5399A Thesis
CS 5399B Thesis
CS 5999B Thesis

Total Hours 30

Background Requirements
Students are required to fulfill background course work if they do not have adequate undergraduate computer science background. The background requirements may be reduced if evidence is presented which shows that the applicant has taken equivalent courses elsewhere prior to enrollment at Texas State. Background work must be completed before enrolling in graduate courses.

The minimum undergraduate background requirements for computer science majors are:

1. These courses must be completed with no grade less than "C" and no more than two "Cs."
2. These courses must be completed with no grade less than "C."

The minimum undergraduate background requirements for computer science majors with a forensic systems minor are:

Computer Science 1
CS 1428 Foundations of Computer Science I 4
CS 2308 Foundations of Computer Science II 3
CS 2315 Computer Ethics 3
CS 2318 Assembly Language 3
CS 3358 Data Structures and Algorithms 3
CS 4310 Computer Networks 3
CS 4328 Operating Systems 3
CS 4332 Introduction to Database Systems 3

Mathematics 2
MATH 5358 Applied Discrete Mathematics (or equivalent) 3
Calculus 8

Total Hours 36

1. These courses must be completed with no grade less than "C" and no more than two "Cs."
2. These courses must be completed with no grade less than "C."
Mathematics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2471</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2472</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 5358</td>
<td>Applied Discrete Mathematics</td>
<td>3</td>
</tr>
</tbody>
</table>

Other

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG 3313</td>
<td>Software Documentation for Computer Science Majors</td>
<td>3</td>
</tr>
<tr>
<td>or ENG 5313</td>
<td>Studies in Principles of Technical Communication</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours: 39

1. These courses must be completed with no grade less than "C" and no more than two "Cs".

If a student elects to follow the thesis option for the degree, a committee to direct the written thesis will be established. The thesis must demonstrate the student’s capability for research and independent thought. Preparation of the thesis must be in conformity with the Graduate College Guide to Preparing and Submitting a Thesis or Dissertation.

**Thesis Proposal**


The student must submit an official Thesis Proposal Form (http://www.gradcollege.txstate.edu/forms.html) and proposal to his or her thesis committee. Thesis proposals vary by department and discipline. Please see your department for proposal guidelines and requirements. After signing the form and obtaining committee members’ signatures, the graduate advisor’s signature if required by the program and the department chair’s signature, the student must submit the Thesis Proposal Form with one copy of the proposal attached to the dean of The Graduate College for approval before proceeding with research on the thesis. If the thesis research involves human subjects, the student must obtain exemption or approval from the Texas State Institutional Review Board prior to submitting the proposal form to The Graduate College. If the thesis research involves vertebrate animals, the proposal form must include the Texas State IACUC approval code. It is recommended that the thesis proposal form be submitted to the dean of The Graduate College by the end of the student’s enrollment in 5399A. Failure to submit the thesis proposal in a timely fashion may result in delayed graduation.

**Thesis Committee**

The thesis committee must be composed of a minimum of three approved graduate faculty members.

**Thesis Enrollment and Credit**

The completion of a minimum of six hours of thesis enrollment is required. For a student’s initial thesis course enrollment, the student will need to register for thesis course number 5399A. After that, the student will enroll in thesis B courses in their field, e.g., ENG 5399A, ENG 5199B, ENG 5299B, ENG 5399B, ENG 5599B, and ENG 5999B, in each subsequent semester until the thesis is defended with the department and approved by The Graduate College. Preliminary discussions regarding the selection of a topic and assignment to a research supervisor will not require enrollment for the thesis course.

Students must be enrolled in thesis credits if they are receiving supervision and/or are using university resources related to their thesis work. The number of thesis credit hours students enroll in must reflect the amount of work being done on the thesis that semester. It is the responsibility of the committee chair to ensure that students are making adequate progress toward their degree throughout the thesis process. Failure to register for the thesis course during a term in which supervision is received may result in postponement of graduation. After initial enrollment in 5399A, the student will continue to enroll in a thesis B course as long as it takes to complete the thesis. Thesis projects are by definition original and individualized projects. As such, depending on the topic, methodology, and other factors, some projects may take longer than others to complete. If the thesis requires work beyond the minimum number of thesis credits needed for the degree, the student may enroll in additional thesis credits at the committee chair’s discretion. In the rare case when a student has not previously enrolled in thesis and plans to work on and complete the thesis in one term, the student will enroll in both 5399A and 5399B.

The only grades assigned for thesis courses are PR (progress), CR (credit), W (withdrawn), and F (failing). If acceptable progress is not being made in a thesis course, the instructor may issue a grade of F. If the student is making acceptable progress, a grade of PR is assigned until the thesis is completed. The minimum number of hours of thesis credit (“CR”) will be awarded only after the thesis has been both approved by The Graduate College and released to Alkek Library.

A student who has selected the thesis option must be registered for the thesis course during the term or Summer I (during the summer, the thesis course runs ten weeks for both sessions) in which the degree will be conferred.

**Fee Reduction**

A master’s degree candidate for graduation may be eligible for a one-time fee reduction under V.T.C.A. Education Code, Section 54.054. Please refer to the section titled Fee Reduction in the Additional Fees and Expenses chapter of this catalog for more information.

**Thesis Deadlines and Approval Process**

Thesis deadlines are posted on The Graduate College (http://www.gradcollege.txstate.edu) website under "Current Students." The completed thesis must be submitted to the chair of the thesis committee on or before the deadlines listed on The Graduate College website.

The following must be submitted to The Graduate College by the thesis deadline listed on The Graduate College website:

1. The Thesis Submission Approval Form bearing original (wet) and/or electronic signatures of the student and all committee members.
2. One (1) PDF of the thesis in final form, approved by all committee members, uploaded in the online Vireo submission system.

After the dean of The Graduate College approves the thesis, Alkek Library will harvest the document from the Vireo submission system for publishing in the Digital Collections database (according to the student’s embargo selection). **NOTE: MFA theses will have a permanent embargo and will never be published to Digital Collections.**

While original (wet) signatures are preferred, there may be situations as determined by the chair of the committee in which obtaining original signatures is inefficient or has the potential to delay the student’s
progress. In those situations, the following methods of signing are acceptable:

- signing and faxing the form
- signing, scanning, and emailing the form
- notifying the department in an email from their university's or institution's email account that the committee chair can sign the form on their behalf
- electronically signing the form using the university’s licensed signature platform.

If this process results in more than one document with signatures, all documents need to be submitted to the Graduate College together.

No copies are required to be submitted to Alkek Library. However, the library will bind copies submitted that the student wants bound for personal use. Personal copies are not required to be printed on archival quality paper. The student will take the personal copies to Alkek Library and pay the binding fee for personal copies.

Master's level courses in Computer Science: CS

Courses Offered
Computer Science (CS)

CS 5100. Advanced Computer Science Internship.
This course provides advanced training supervised by computer scientists in internship programs approved by the department. Course credit cannot be counted toward any graduate degree, is open only to majors in the Department of Computer Science. May be repeated once but not for credit and requires approval of the department chair.

1 Credit Hour. 0 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Exclude from 3-peat Processing|Graduate Assistantship|Exclude from Graduate GPA
Grade Mode: Leveling/Assistantships

CS 5199B. Thesis.
This course represents a student's continuing thesis enrollments. The student continues to enroll in this course until the thesis is submitted for binding. Graded on a credit (CR), progress (PR), no-credit (F) basis.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

CS 5299B. Thesis.
This course represents a student's continuing thesis enrollments. The student continues to enroll in this course until the thesis is submitted for binding. Graded on a credit (CR), progress (PR), no-credit (F) basis.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

CS 5300. Professional Development of Graduate Assistants.
This course is designed to develop and enhance the professional and technical skills of graduate teaching and instructional assistants. Topics covered may include, but are not limited to, teaching skills, technical skills, ethical and legal issues, and laboratory management. This course does not earn graduate degree credit. Graded on a credit (CR), no-credit (F) basis.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Graduate Assistantship|Exclude from Graduate GPA
Grade Mode: Leveling/Assistantships

CS 5301. Programming Practicum.
Intensive review of programming through data structures. Includes syntax, semantics, problem solving, algorithm development, and in-class exercises. May be repeated once. Does not count for credit toward any graduate degree. Prerequisite: CS 3358 with a grade of C or higher, or consent of instructor.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from Graduate GPA|Leveling
Grade Mode: Leveling/Assistantships

A study of modern operating systems including network, distributed, or real-time systems. Prerequisites: CS 3358 and CS 4328.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

A study of network and communication systems. Verification and/or implementation of protocols will be required. Prerequisite: CS 3358.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5316. Data Mining.
This course covers fundamental concepts and techniques plus recent developments in data mining and information retrieval. It provides relevant research training and practice opportunities. May not be taken for credit if student received credit for CS 4315. Prerequisite: CS 3358 with a grade of C or higher.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5318. Principles of Programming Languages.
This course focuses on the principles of programming languages. Topics covered include programming paradigms, concepts of programming languages, formal syntax and semantics, and language implementation issues. Prerequisite: CS 3358 with a grade of C or higher.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

Professional level presentation of techniques and research findings related to human-computer interactions. Prerequisite: CS 3358.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5329. Algorithm Design and Analysis.
Introduction to algorithm design and analysis, computational complexity, NP-completeness theory. Prerequisites: CS 3358, MATH 2472, and MATH 3398 or MATH 5358 with a grade of "C" or higher.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5331. Crafting Compilers.
Overview of the internal structure of modern compilers. Research on compilation techniques. Topics include lexical scanning, parsing techniques, static type checking, code generation, dataflow analysis, storage management, and execution environments. Prerequisite: CS 3358 with a grade of "C" or higher.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
CS 5332. Data Base Theory and Design.
Computer system organization for the management of data; data models, data model theory, optimization and normalization; integrity constraints; query languages; intelligent database systems. Prerequisites: CS 3358 and CS 4328
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5334. Advanced Internet Information Processing.
Integration of popular scripting languages (Perl, JavaScript, PHP, and other CGI capable languages) and database programming languages (embedded database programming languages, JavaServlets, and PHP) to provide advanced information processing for Internet applications that demand both database support and sophisticated, application specific information processing. Prerequisite: CS 4332 or CS 5332 with a grade of "C" or higher
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5335. Research in Object-Oriented System Development.
The course covers the object-oriented methodologies for system analysis, design, implementation, testing, and other aspects of system development. Emphasis will be on using OO methodologies to manage the complexity of complicated software. Other topics like modeling, OODB, and OO languages will also be covered. Prerequisites: CS 3358, and either CS 4332 or CS 5332 with grades of C or higher
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5338. Formal Languages.
Advanced topics in automata theory, grammars, Turing machines, decidability, and algorithmic complexity. Prerequisites: CS 3358 and MATH 3398
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

Study of advanced concepts and programming skills in computer networks such as advanced TCP/IP, API, multicasting and broadcasting, reliable communications, advanced I/O functions and options. Prerequisite: CS 5310 with a grade of C or higher
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5343. Wireless Communications and Networks.
Study of the fundamental aspects of wireless communications and wireless/mobile networking APIs. Prerequisites: CS 3358 with a grade of B or higher and CS 5310 with a grade of C or higher
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5346. Advanced Artificial Intelligence.
Knowledge representation; knowledge engineering; parallel and distributed AI; heuristic searches; machine learning and intelligent databases; implementation of systems in high-level AI languages. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5348. Computer Organization and Design.
This course covers the dynamic interaction of the computer system building blocks and their management. Course topics include the design of the instruction set, high speed arithmetic, memory hierarchy, and control units. Computer system performance evaluation methodology and techniques are also covered. Prerequisites: CS 3339 and CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5351. Parallel Processing.
Introduction to the design and analysis of parallel algorithms, parallel architectures, and computers. Prerequisites: CS 3358 and CS 4328
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5352. Distributed Computing.
Study of advanced topics in distributed systems: concurrency control and failure recovery, management of replicated data, distributed consensus and fault tolerance, remote procedure calls, naming and security. Prerequisites: CS 3358 and CS 4328
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5369G. Web Service Engineering.
Advanced concepts and techniques for enabling Web application integration and interaction using Semantic Web and Web services. Concepts and techniques include service discovery ontology (RDF, DAML-S), XML-based interactions standards (ebXML, RosettaNet) and Web Services (WSDL, SOAP, UDDI, BPEL). Prerequisite: CS 3358 with a grade of C or higher
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter

CS 5369J. Advanced Human Computer Interaction.
This course will cover state of the art human computer interaction topics such as perceptual compression, eye-gaze, and brain computer interfaces with emphasis on the human visual system, eye-tracking, and electroencephalography. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter

CS 5369L. Machine Learning and Applications.
Provides broad introduction to machine learning, including learning theory, and recent topics like support vector machines and feature selection. Covers basic ideas, intuition, and understanding behind modern machine learning methods. Discusses applications like face recognition, text recognition, biometrics, bioinformatics, and multimedia retrieval. Prerequisite: CS 3358 grade of C or higher
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
CS 5369M. Software Evolution and Maintenance.
Software evolution and maintenance is one of the most important and complex activities in software engineering. Programmers rarely build software from scratch but often modify existing software to fix defects or add new features. This course studies the fundamentals of cutting-edge techniques and tools for software evolution and maintenance. Prerequisite: CS 3358 with a grade of "C" or higher
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

CS 5391. Survey of Software Engineering.
A study of the software life cycle with emphasis on system analysis and design. Methodologies based on data flows and on objects will be surveyed. A component on professional ethics is included. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

The use of design and specification languages in producing software systems. Emphasis is placed on proving correctness of designs and implementations. Prerequisites: CS 3358 and CS 5391
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5394. Advanced Software Engineering Project.
Students produce a software project of significant size in a team environment. All aspects of the software engineering course sequence are integrated and put into practice. Prerequisite: CS 5391
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

Open to graduate students on an independent basis by arrangement with the faculty member concerned. Course is not repeatable for credit. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

A study of the algorithms and data structures used in representing and processing visual data. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5389. Graphical User Interfaces.
Covers both abstract and practical treatments of using graphics to implement interactive computer/human interfaces. Includes a survey of the major GUI standards and tools. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

This course covers various aspects of producing secure computer information systems that provide guaranteed controlled sharing. Emphasis is on software models and design, including discovery and prevention of computing systems security vulnerabilities. Current systems and methods are examined and critiqued. Prerequisite: CS 3358 with a grade of C or higher
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5374. Neural Networks.
A study of neural computing, including basic concepts, algorithms, and applications; back propagation and counter propagation networks; Hopfield networks; associative memories; massively parallel neural architectures; adaptive resonance theory; optical neural networks; connectionist approaches. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

A study of the digital representation and processing of major multimedia data types: image, audio, and video. Compression techniques for the three data types, standards, and storage media. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5376. Enterprise Application Integration.
Introduction to the integration of all services available on the Web. It emphasizes component-based integration frameworks based on J2EE specification (EJB, Servlets, JMS), inter-organization workflow integration frameworks, and XML framework. Students must have knowledge of object-oriented design, object-oriented programming language, databases, and networking. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

This course covers various aspects of producing secure computer information systems that provide guaranteed controlled sharing. Emphasis is on software models and design, including discovery and prevention of computing systems security vulnerabilities. Current systems and methods are examined and critiqued. Prerequisite: CS 3358 with a grade of C or higher
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

This course covers various aspects of producing secure computer information systems that provide guaranteed controlled sharing. Emphasis is on software models and design, including discovery and prevention of computing systems security vulnerabilities. Current systems and methods are examined and critiqued. Prerequisite: CS 3358 with a grade of C or higher
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

A study of the algorithms and data structures used in representing and processing visual data. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5389. Graphical User Interfaces.
Covers both abstract and practical treatments of using graphics to implement interactive computer/human interfaces. Includes a survey of the major GUI standards and tools. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5391. Survey of Software Engineering.
A study of the software life cycle with emphasis on system analysis and design. Methodologies based on data flows and on objects will be surveyed. A component on professional ethics is included. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

The use of design and specification languages in producing software systems. Emphasis is placed on proving correctness of designs and implementations. Prerequisites: CS 3358 and CS 5391
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5393. Software Quality.
The latter half of the software life cycle is discussed. Topics include testing, performance evaluation, and software metrics. Appropriate software tools are studied and used. Prerequisite: CS 5391
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5394. Advanced Software Engineering Project.
Students produce a software project of significant size in a team environment. All aspects of the software engineering course sequence are integrated and put into practice. Prerequisite: CS 5391
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

Open to graduate students on an independent basis by arrangement with the faculty member concerned. Course is not repeatable for credit. Prerequisite: CS 3358
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit
The essentials of software engineering processes, methods, and tools for
the evolutionary design of complex interactive software are discussed.
Overviews of other topics like quality concepts, SEI CMM, information
technology, and network technology are covered. Student completes a
literature survey of the latest software engineering analysis and design
processes, methods, and tools. Prerequisite: CS 5391

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CS 5399A. Thesis.
This course represents a student’s initial thesis enrollment. No thesis
credit is awarded until the student has completed the thesis in CS 5399B.
Graded on a credit (CR), progress (PR), no-credit (F) basis

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

CS 5399B. Thesis.
This course represents a student’s continuing thesis enrollment. The
student continues to enroll in this course until the thesis is submitted for
binding. Graded on a credit (CR), progress (PR), no-credit (F) basis

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

CS 5599B. Thesis.
This course represents a student’s continuing thesis enrollments. The
student continues to enroll in this course until the thesis is submitted for
binding. Graded on a credit (CR), progress (PR), no-credit (F) basis

5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

CS 5999B. Thesis.
This course represents a student’s continuing thesis enrollments. The
student continues to enroll in this course until the thesis is submitted for
binding. Graded on a credit (CR), progress (PR), no-credit (F) basis

9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit