COMPUTER SCIENCE

Department Overview

The Department of Computer Science at Saint Joseph's University offers the following degrees:

- B.S. Computer Science,
- B.S. Information Technology, and
- M.S. Computer Science.

The department has earned ABET (Accreditation Board For Engineering And Technology) accreditation of its B.S in Computer Science program.

Professor: Babak Forouraghi, Ph.D.
Associate: George J. Grevera, Ph.D.; Susanna Wei, Ph.D.
Assistant: Wei Chang
Adjunct: Mary Krueger

Undergraduate

- Bachelor of Science in Computer Science (https://academiccatalog.sju.edu/arts-sciences/computer-science/bs-computer-science)
- Bachelor of Science in Information Technology (https://academiccatalog.sju.edu/arts-sciences/computer-science/information-technology-major)

Undergraduate Minors

- Computer Science (https://academiccatalog.sju.edu/arts-sciences/computer-science/minor-computer-science)
- Information Technology (https://academiccatalog.sju.edu/arts-sciences/computer-science/minor-information-technology)

Graduate

- Master of Science in Computer Science (https://academiccatalog.sju.edu/arts-sciences/computer-science/ms-computer-science)

CSC 110 Building Virtual Worlds (3 credits)
A gentle introduction to programming with user-friendly software (Alice). Students will use 3D animated interactive virtual worlds to develop an understanding of basic programming constructs. Open to all students. Computer science majors may take this course to prepare for CSC 120. This course presupposes no previous programming experience. Attributes: Undergraduate

CSC 115 Intro to Computer Science (3 credits)
A gentle introduction to computer science. Students will be introduced to basic programming constructs in a language such as Python. Open to all students. Computer science majors may take this course to prepare for CSC 120. This course presupposes no previous programming experience. Attributes: Undergraduate

CSC 120 Computer Science I (4 credits)
Computer programming for beginners. Very little prior knowledge regarding how computers work is assumed. Learn how to write understandable computer programs in a programming language widely used on the Internet. Go beyond the routine skills of a computer user and learn the programming fundamentals: data, variables, selection, loops, arrays, input/output, methods and parameter passing, object and classes, abstraction. Take what is learned and write programs for use on the Internet. One hour per week of the course is a required laboratory. Attributes: Undergraduate

CSC 121 Computer Science II (4 credits)
The course covers intermediate programming techniques emphasizing advanced object oriented techniques including inheritance, polymorphism, and interfaces. Other topics include recursion, exception handling, design patterns, simple GUI programming, and dynamic containers such as linked lists, stacks, queues, and trees. Prerequisites: CSC 1501 or CSC 1505 or CSC 120 Attributes: Undergraduate

CSC 125 CSC I: Programming Fundamentals (3 credits)
CSC 126 CSC II: Intermed Prog Technique (3 credits)
CSC 150 First-Year Seminar (3 credits)
CSC 201 Data Structures (4 credits)
The course covers fundamental data structures, algorithms for manipulating and retrieving information from these data structures, and techniques for analyzing their efficiency in terms of space and time. The distinction between an Abstract Data Type and its implementation is emphasized. Topics include lists, vectors, trees (general trees, binary search trees, and balanced trees), priority queues, hashing, graphs, and various searching and sorting algorithms. Prerequisites: CSC 121 Attributes: Undergraduate

CSC 202 Computer Architecture (3 credits)
Overview of computer system organization, hardware, and communications. Introduction to combinational and sequential logic, arithmetic, CPU, memory, microprocessors, and interfaces. CISC vs. RISC processors. Assembly language programming, microarchitecture, and microprogramming on a variety of processors. Prerequisites: CSC 121 Attributes: Undergraduate

CSC 240 Discrete Structures I (3 credits)
Topics include finite probability space, conditional probability, Bayes’ theorem, permutations and combinations, statistics and sampling distributions, the Central Limit Theorem, hypothesis testing, correlation, regression analysis, data encoding, channel capacity, the Shannon coding theorem. Data analysis projects using an appropriate statistical package will be assigned. CS & IT Prerequisite: CSC 121, or permission of the CSC chair. Restrictions: Graduate level students may not enroll.

CSC 241 Discrete Structures II (3 credits)
Mathematics needed for Computer Science. Topics covered include: functions, relations, propositional and first order predicate logic, set theory, proofs and their construction, counting and elementary probability. The course will use a declarative language as a tool to support concrete implementations of the mathematical ideas. CS & IT Prerequisite: CSC 240.
CSC 261 Principles of Programming Lang (3 credits)
The general principles underlying programming languages, including such topics as syntax and its specification, data types, data control, flow control, storage management and support for design patterns. Examples drawn from a variety of programming languages, including functional, logical and procedural languages, will be presented.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 281 Design & Analysis Algorithms (3 credits)
This course presents fundamental techniques for designing efficient computer algorithms and analyzing their running times. Topics include asymptotics, solving summations and recurrences, sorting and selection, graph algorithms (depth-first and breadth-first search, minimum spanning trees, and shortest paths), algorithm design techniques (divide-and-conquer, dynamic programming, and greedy algorithms), and introduction to NP-completeness.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 310 Computer Systems (3 credits)
An overview of operating systems and the software required to integrate computer hardware into a functional system. Topics include operating systems structure, interrupt driven systems, concurrency, memory management, file systems and security, and system calls.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 315 Software Engineering (3 credits)
Principles of designing large programs, including issues of specification, documentation, design strategies, coding, testing and maintenance. Students work in small groups to design and implement a major software project.
Prerequisites: (CSC 201 or CSC 2301 or MAT 2305)
Attributes: Undergraduate

CSC 341 Introduction to Graphics (3 credits)
Principles of designing large programs, including issues of specification, documentation, design strategies, coding, testing and maintenance. Students work in small groups to design and implement a major software project.
Prerequisites: (CSC 201 or CSC 2305 or CSC 2301)
Attributes: Undergraduate

CSC 342 Computer Vision (3 credits)
Computer vision is the science of analyzing images and videos in order to recognize or model 3D objects, persons, and environments. Topics include the underlying image formation principles, extracting simple features like prominent points or lines in images, projecting a scene to a picture, tracking features and areas in images and make a mosaic, making an image-based positioning system, obtaining 3D models from two or more images, and techniques to recognize simple patterns and objects. The class includes programming exercises and hands-on work with digital cameras and laser scanners.
Prerequisites: CSC 281
Attributes: Undergraduate

CSC 343 Interactive 3D Game Developmt (3 credits)
This course will cover the tools and techniques for programming interactive games and virtual reality simulations. The focus is primarily on programming aspects, including event loops and execution threads, rendering and animation in 3D, terrain/background representation, polygonal models, texturing, collision detection and physically-based modeling, game AI, and multi-user games and networking. Although this course has a significant programming focus, other topics briefly covered will include the history of computer/video game technology, game genres and design principles, and the social impact of games.
Prerequisites: CSC 201 or CSC 2305 or CSC 201
Attributes: Undergraduate

CSC 344 Human Computer Interaction (3 credits)
User models: conceptual, semantic and syntactic considerations; cognitive and social issues for computer systems; evaluating the interface; direct manipulation; architectures for Interaction; Students will design and implement a GUI based application.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 351 Database Management Systems (3 credits)
The course will cover the concepts and structures necessary to design and implement a relational database system. Topics to be covered: entity-relationship and relational data models, relational algebra, SQL, normalization, file organization, indexing, hashing, and enterprise-wide web-based applications. CS Prerequisite: CSC 281 or permission of the CSC chair. IT Prerequisite: CSC 201 or permission of the CSC chair.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 352 Data Communication & Networks (3 credits)
Topics include mathematical foundations of data communications, logical and physical organization of computer networks, the ISO and TCP/IP models, communication protocols, circuit and packet switching, the Internet, LAN/WAN, client/server communications via sockets, routing protocols, data encryption/decryption and network security issues.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 353 Internet Application Develpmnt (3 credits)
This course will attempt to give you experience in designing Internet applications. A student finishing this course should be able to design, implement, and maintain a large community or e-commerce web site. They should leave the course with an understanding of a variety of Internet protocols and markup languages, a knowledge of at least one common scripting tool, an understanding of how to implement a database back-end into a large-scale site, and the ability to critically assess the usability of both their design and the design others.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 354 Web Technologies (3 credits)
Topics include organization of Meta-Markup languages, Document Type Definitions (DTD), document validity and well-formedness, style languages, namespaces, Transformations, XML parsers, and XQuery. Course includes programming projects.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate
CSC 355 Cryptography & Network Security (3 credits)
Topics include classical cryptosystems, public and symmetric cryptography, key management, digital signatures, cipher techniques, authentication and federated identity management. Course also covers concepts relating to crypto-virology, malware, viruses, Trojan horses, worms and other types of infectors as they relate to network security. Course includes programming projects.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 356 Mobile App Design (3 credits)
This course is designed for students who wish to start developing mobile applications on Android platforms, and through the process understand the concepts relating to Computer Science on a mobile platform. The course will include the basics of mobile and wireless technology with Android programming and will cover the most recent version of Android. Students will learn how to develop feature-rich Android applications using various development platforms and learn the basic concepts in Computer Science such as algorithmic thinking, abstractions, logic, flow control, and data representation, storage and manipulation. The primary language used in the course will be Java.
Prerequisites: CSC 281
Attributes: Undergraduate

CSC 359 Security in Mobile App Design (3 credits)
The course introduces students on how to implement and enforce access and data protection measures for mobile applications using data encryption standards, VPN policies, and authentication. The focus of the course is on the integration between the mobile application and remote authentication services. The course include Android programming projects using security specific SDK's.
Prerequisites: CSC 281
Attributes: Undergraduate

CSC 361 Formal Lang & Compiler Constrctn (3 credits)
Introduction to formal languages and abstract machines: finite automata and regular sets, context free grammars and pushdown automata. Syntax trees and decorated trees. Application of these ideas to the construction of compilers and other language translation software. The course will include programming projects that will illustrate the major features of compiler construction.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 362 Artificial Intelligence (3 credits)
The course covers fundamental concepts such as role of logic in reasoning, deductive proofs, and blind and informed search techniques. Additional topics may include inductive learning, genetic algorithms, decision trees, planning, natural language processing, game trees and perceptron learning.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 363 Theoretical Foundations (3 credits)
Introduction to formal models of languages and computation. Topics covered include finite automata, regular languages, context-free languages, pushdown automata, Turing machines, computability, and NP-completeness.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 370 Topics in Computer Science (3 credits)
The course introduces students to recent theoretical or practical topics of interest in computer science. Content and structure of the course are determined by the course supervisor. The special topic(s) for a given semester will be announced prior to registration.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 490 Internship (3 credits)
The course goals are: to gain first-hand experience of the daily activities of professionals in computer science and related fields, to verify an interest in a particular area of computer science, to develop and hone skills required for computer science professions, to establish contacts outside the academic community who will facilitate a career in computer science. An internship journal and a report are also required.
Prerequisites: CSC 201 or CSC 2301 or CSC 2305
Attributes: Undergraduate

CSC 493 Independent Study (3 credits)
A one- or two-semester, independent research project on a topic selected by the student and a faculty research advisor, and approved by the department. The student may undertake the two-semester option to graduate with departmental honors, in which case he/she must notify the department by spring of his/her junior year. Students need to complete the application form for independent study (available in the Dean’s Office), meet the GPA and other requirements, and have the approval of the Computer Science Department chair and Associate Dean in order to register.
Prerequisites: CSC 281 or CSC 2281
Attributes: Undergraduate

CSC 494 Independent Study (3 credits)
A one- or two-semester, independent research project on a topic selected by the student and a faculty research advisor, and approved by the department. The student may undertake the two-semester option to graduate with departmental honors, in which case he/she must notify the department by spring of his/her junior year. Students need to complete the application form for independent study (available in the Dean’s Office), meet the GPA and other requirements, and have the approval of the Computer Science Department chair and Associate Dean in order to register.
Prerequisites: CSC 281 or CSC 2281
Attributes: Undergraduate

CSC 495 Computer Science Project (3 credits)
Students will work on a substantial application based upon their prior knowledge.
Prerequisites: (CSC 2301 or CSC 2305) or CSC 201
Attributes: Undergraduate

CSC 500 Discrete Structures (3 credits)
Mathematics needed for Computer Science. Topics covered include: functions, relations, propositional and first order predicate logic, set theory, proofs and their construction, counting and elementary probability. The course will use a declarative language as a tool to support concrete implementations of the mathematical ideas.
Restrictions: Enrollment is limited to Graduate level students.
CSC 501 Computer Science I (3 credits)
This is an intensive, one-semester, two-course sequence intended to provide students with the necessary background in programming for the graduate program. The use of the computer to solve problems. Students will learn general principles of program design, at first by using libraries of predefined program units, and later, by constructing complete programs. Emphasis is on developing techniques for program design that lead to correct, readable and maintainable programs. Intermediate programming techniques including the use of recursion. An introduction to encapsulated data structures. Lists and list sorting will be used to introduce a discussion of algorithm efficiency.
Restrictions: Enrollment is limited to Graduate level students.

CSC 502 Computer Science II (3 credits)
This is an intensive, one-semester, two-course sequence intended to provide students with the necessary background in programming for the graduate program. The use of the computer to solve problems. Students will learn general principles of program design, at first by using libraries of predefined program units, and later, by constructing complete programs. Emphasis is on developing techniques for program design that lead to correct, readable and maintainable programs. Intermediate programming techniques including the use of recursion. An introduction to encapsulated data structures. Lists and list sorting will be used to introduce a discussion of algorithm efficiency.
Prerequisites: CSC 3505 (may be taken concurrently) or CSC 501 (may be taken concurrently) or CSC 3405 Placement Score with a score of 1
Restrictions: Enrollment is limited to Graduate level students.

CSC 550 Object Orient Design & Data Struct (3 credits)
The course combines a strong emphasis on Object-Oriented Design principles and design patterns with the study of data structures.
Fundamental Abstract Data Types, their implementations and techniques for analyzing their efficiency will be covered. Students will design, build, test, debug and analyze medium-size software systems and learn to use relevant tools.
Prerequisites: CSC 502 or CSC 3605
Restrictions: Enrollment is limited to Graduate level students.

CSC 551 Design and Analysis (3 credits)
Concepts of program complexity; basic approaches to complexity reduction: data structures and techniques; worst cases and expected complexity. Topics to be covered may include sorting, set manipulation, graph algorithms, matrix multiplication, and finite Fourier transforms, polynomial arithmetic, and pattern matching.
Prerequisites: CSC 4005 or CSC 550
Restrictions: Enrollment is limited to Graduate level students.

CSC 552 Computer Architecture (3 credits)
Overview of computer system organization, hardware components, and communications. Introduction to Boolean algebra, combinational and sequential logic, arithmetic, the CPU, memory, microprocessors, and interfaces. CISC vs. RISC processors. Practical assembly language programming will be the emphasis with an introduction to micro architecture and microprogramming on a variety of processors.
Prerequisites: CSC 501 or CSC 3405
Restrictions: Enrollment is limited to Graduate level students.

CSC 553 Computer Systems (3 credits)
An overview of the software required to integrate computer hardware into a functional system. The following topics are covered. Operating systems as resource managers and as virtual machines. System calls, in particular those required for process and file management; interrupt driven systems; concurrency; memory management; file systems and security.
Prerequisites: CSC 550 or CSC 4005
Restrictions: Enrollment is limited to Graduate level students.

CSC 554 Theory of Computation (3 credits)
Formal languages, formal grammars, abstract machines; models of computation (e.g. Turing machines); computational complexity (NP completeness); undecidability and uncomputability.
Prerequisites: CSC 500
Restrictions: Enrollment is limited to Graduate level students.

CSC 560 Software Engineering (3 credits)
The purpose of this class is to teach the process of developing software. It combines a study of methods, tools, and techniques for creating and evolving software products, with the practical skills needed to deliver high-quality software products on schedule. The methods that are studied include requirements, specification, design, implementation, testing, and maintenance. The course includes a substantial group project.
Prerequisites: CSC 550 or CSC 4005
Restrictions: Enrollment is limited to Graduate level students.

CSC 561 Internet Applications Development (3 credits)
This course will attempt to give you experience in designing Internet applications. A student finishing this course should be able to design, implement, and maintain a large community or e-commerce web site. They should leave the course with an understanding of a variety of Internet protocols and markup languages, a knowledge of at least one common scripting tool, an understanding of how to implement a database back-end into a large-scale site, and the ability to critically assess the usability of both their design and the design others.
Prerequisites: CSC 502
Restrictions: Enrollment is limited to Graduate level students.
CSC 621 Database Systems (3 credits)
This course covers the concepts and structures necessary to design and implement a database management system. Topics to be covered: data models (entity-relationship and relational), SQL, normalization, storage structures, enterprise applications and database integrity.
Prerequisites: CSC 550 or CSC 4005
Restrictions: Enrollment is limited to Graduate level students.

CSC 622 Advanced Database Concepts (3 credits)
Topics include stored procedures, triggers, query processing and optimization, web-based enterprise data applications, transaction management, concurrency control, distributed databases, data mining and web mining. The course includes programming projects involving SQL.
Prerequisites: CSC 621 or CSC 5215
Restrictions: Enrollment is limited to Graduate level students.

CSC 623 Data Comm and Networking (3 credits)
Topics include mathematical foundations of data communications, logical and physical organization of computer networks, the ISO and TCP/IP models, communication protocols, circuit and packet switching, the Internet, LAN/WAN, client/server communications via sockets, routing protocols, data encryption/decryption and network security issues.
Prerequisite: CSC 550 Object Oriented Design and Data Systems.
Restrictions: Enrollment is limited to Graduate level students.

CSC 626 Web Technologies (3 credits)
Topics include organization of Meta-Markup languages, Document Type Definitions (DTDs), document validity and well-formedness, style languages, namespaces, Transformations, XML parsers, Web Services, and Web Security Specifications. Course includes programming projects.
Prerequisites: CSC 550 or CSC 4005
Restrictions: Enrollment is limited to Graduate level students.

CSC 627 Introduction to Security (3 credits)
Topics include fundamental concepts in confidentiality, integrity, and availability, access control methods, cryptographic concepts, physical security, malware, computer viruses, privacy-invasive software, malware detection, network security, web security, security models, software vulnerability assessment.
Restrictions: Enrollment is limited to Graduate level students.

CSC 628 Advanced Security (3 credits)
Topics include classical cryptosystems, public and symmetric cryptography, key management, digital signatures, cipher techniques, authentication and federated identity management. Course also covers concepts relating to cryptovirology, malware, viruses, Trojan horses, worms and other types of infectors as they relate to network security. Course includes programming projects. Prerequisite: CSC 550 Object Oriented Design and Data Structures.
Restrictions: Enrollment is limited to Graduate level students.

CSC 629 Mobile App Design (3 credits)
This course is designed for students who wish to start developing mobile applications on Android platforms, and through the process understand the concepts relating to Computer Science on a mobile platform. The course will include the basics of mobile and wireless technology with Android programming and will cover the most recent version of Android. Students will learn how to develop feature-rich Android applications using various development platforms and learn the basic concepts in Computer Science such as algorithmic thinking, abstractions, logic, flow control, and data representation, storage and manipulation. The primary language used in the course will be Java. Prerequisite: CSC 551 Design and Analysis of Algorithms.
Prerequisites: CSC 550

CSC 630 Introduction to Graphics (3 credits)
The course provides an introduction to the principles of computer graphics. The emphasis will be placed on understanding how various elements that underlie computer graphics interact in the design of graphics software systems. Topics include pipeline architecture, graphics programming, 3D geometry and transformations, modeling, viewing, clipping and projection, lighting, shading and texture mapping and visibility determination. A standard graphics API will be used to reinforce concepts and the study of basic graphics algorithms. Students need some proficiency in C language and basic concepts from Linear Algebra.
Prerequisites: CSC 550 or CSC 4005
Restrictions: Enrollment is limited to Graduate level students.

CSC 631 Computer Vision (3 credits)
Computer vision is the science of analyzing images and videos in order to recognize or model 3D objects, persons, and environments. Topics include the underlying image formation principles, extracting simple features like prominent points or lines in images, projecting a scene to a picture, tracking features and areas in images and make a mosaic, making an image-based positioning system, obtaining 3D models from two or more images, and techniques to recognize simple patterns and objects. The class includes programming exercises and hands-on work with digital cameras and laser scanners.
Prerequisites: CSC 550 or CSC 4005
Restrictions: Enrollment is limited to Graduate level students.

CSC 632 Interactive 3D Game Development (3 credits)
This is a technology-based course that uses the latest computer games technology to teach advanced programming, mathematics, and software development. The course is ideal for students with an interest in computer games who plan to seek employment in one of the country’s more profitable industries, or students looking for a career in new technologies or software development. The interactive entertainment industry in the US and throughout the world is entering a new phase. New technology platforms are forcing existing development firms to diversify. There are many aspects of game design, development, production, finance, and the distribution process.
Prerequisites: CSC 550 or CSC 4005
Restrictions: Enrollment is limited to Graduate level students.

CSC 633 Advanced Graphics (3 credits)
The goal of this course is to expose students to advanced techniques in modeling and rendering in computer graphics and visualization. Topics include parametric curves and surfaces, mesh representation, multisresolution modeling, mesh simplification, ray-tracing, radiosity and volume rendering (iso-rendering and direct volume rendering), anti-aliasing and animation.
Prerequisites: CSC 630 or CSC 5305
Restrictions: Enrollment is limited to Graduate level students.

CSC 634 Computational Geometry (3 credits)
The course covers design, implementation and analysis of data structures and algorithms for solving geometric problems concerning objects like points, lines, polygons in 2-dimensional space and in higher dimensions. The course emphasizes the applications of computational geometry. Topics include overview of geometric concepts, curves and surfaces, data structures for representing solid models, convex hulls, line segment intersection, multi-dimensional data structures (kd-trees, quadtrees and BSP trees), and range searching, point location, triangulations and Voronoi diagrams.
Prerequisites: CSC 551 or CSC 4015
Restrictions: Enrollment is limited to Graduate level students.
CSC 643 Big Data and Web Intelligence (3 credits)
The course explores the concepts of big data, the use of Artificial Intelligence data exploration techniques, the map-reduce parallel computing paradigm, distributed file systems, NoSQL databases, and stream computing engines. The course includes programming projects on a cluster of Hadoop servers.
Prerequisites: CSC 550
Restrictions: Enrollment is limited to Graduate level students.

CSC 644 Security in Mobile App Design (3 credits)
The course introduces students on how to implement and enforce access and data protection measures for mobile applications using data encryption standards, VPN policies, and authentication. The focus of the course is on the integration between the mobile application and remote authentication services. The course include Android programming projects using security specific SDK's
Prerequisites: CSC 550

CSC 670 Topics in CS (3 credits)
The course introduces students to recent theoretical or practical topics of interest in computer science. Content and structure of the course are determined by the course supervisor. The special topics for a given semester will be announced prior to registration. With permission of the Graduate Director the course may be taken more than once.
Prerequisites: CSC 550 or CSC 4005
Restrictions: Enrollment is limited to Graduate level students.

CSC 680 Artificial Intelligence (3 credits)
The course covers fundamental concepts such as role of logic in reasoning, deductive proofs, and blind and informed search techniques. Additional topics may include inductive learning, genetic algorithms, decision trees, planning, natural language processing, game trees and perception learning. Course includes programming projects in a suitable language.
Prerequisites: CSC 502
Restrictions: Enrollment is limited to Graduate level students.

CSC 681 Programming Paradigms (3 credits)
An exploration of the relationships between computational paradigms and the computer languages that support them. The Lambda calculus and functional programming, resolution and logic based languages, machine based models and imperative languages. The impact of the computational model on program structure and language design. A mid-sized programming project will be used to illustrate the concepts.
Prerequisite: CSC 500 Discrete Structures.
Restrictions: Enrollment is limited to Graduate level students.

CSC 682 Numerical Algorithms (3 credits)
Exposition and analysis of numerical methods for modern computers; review of basic concepts in linear algebra; direct and interactive methods for solving linear and nonlinear problems in numerical algebra; basic problems in approximation theory, numerical differentiation and integration; numerical solutions of different equations; forward and backward error analysis of algorithms; criteria for comparing the efficiency and suitability of numerical methods.
Prerequisites: CSC 550 or CSC 4005
Restrictions: Enrollment is limited to Graduate level students.

CSC 683 Information Theory and Coding (3 credits)
Data encoding and transmission; variable length coding; the Kraft inequality for noiseless transmission channels; channel capacity; noise channels and channel capacity; the Shannon coding theorem; algebraic coding schemes. Prerequisite: CSC 500 Discrete Structures.
Restrictions: Enrollment is limited to Graduate level students.

CSC 684 Complexity of Computation (3 credits)
P and NP problems; NP-complete classes; concrete complexity and the P class of combinatorial problems; complexity reduction on graph and string problems; complexity of algebraic computations.
Prerequisites: (CSC 4015 or CSC 551) and (CSC 4025 (may be taken concurrently) or CSC 552 (may be taken concurrently))
Restrictions: Enrollment is limited to Graduate level students.

CSC 690 Computer Science Internship (3 credits)
An approved internship in advanced computer science.

CSC 791 Research Project I (3 credits)
Supervised independent research mentored by a graduate faculty member. Prerequisite: GPA of 3.5 and permission of the Graduate Director.
Restrictions: Enrollment is limited to Graduate level students.

CSC 792 Research Project II (3 credits)
Supervised independent research mentored by a graduate faculty member. Prerequisite: GPA of 3.5 and permission of the Graduate Director.
Restrictions: Enrollment is limited to Graduate level students.

CSC 793 Research Project III (6 credits)
Supervised independent research mentored by a graduate faculty member. Prerequisite: GPA of 3.5 and permission of the Graduate Director.
Restrictions: Enrollment is limited to Graduate level students.