

## Ph.D. Computer Science Course Descriptions

### Required Courses [ALL Students]

Prefix Number	Course Title	Credit Hours	Location
<b>CSC 705</b>	<p><b>Design and Analysis of Computer Algorithms</b></p> <p>Design and analysis of algorithms to determine their time and space requirements. The study of efficient algorithms for various computational problems. Analysis of specific algorithms for internal sorting, hashing, and string search. Sorting manipulation of data structures, graphics, matrix multiplication, the Fast Fourier Transform, arithmetical operations and pattern matching. Study and implication of advanced topics on lists, stacks, trees, sets and dynamic allocation.</p>	3	DSU/SDSU
<b>CSC 710</b>	<p><b>Structure and Design Programming Language</b></p> <p>Evolution of concepts in programming languages. Data and control abstraction. Run-time effects of binding, scope and extent; structure of ALGOL-like and interpretive languages. Data types, problem areas and implementation models. Control structures, exception handling, and concurrency. Functional programming.</p>	3	DSU/SDSU
<b>CSC 718</b>	<p><b>Operating Systems &amp; Parallel Programming</b></p> <p>This course provides a graduate-level introduction to parallel and distributed systems and introduces fundamentals of shared and distributed memory programming to provide hands-on experience of parallel computing. The course will explore algorithms and techniques for programming shared-memory (e.g., multicores) and distributed-memory (e.g., clusters) computer systems. The course will include both theoretical and programming components. Includes the study of parallel computer architecture, memory and I/O. Also, parallel computer algorithms to include shared and distributed memory, parallel computation models, graphic algorithms, and numerical algorithms.</p>	3	DSU
<b>CSC 720</b>	<p><b>Theory of Computation</b></p> <p>Formal models of computation. Recursive function theory, computable functions, decidable and enumerable sets, unsolvable programs, correctness of programs, undecidability and incompleteness and complexity of computation.</p>	3	DSU/SDSU
<b>CSC 722</b>	<p><b>Machine Learning Fundamentals</b></p> <p>A comprehensive study of the theory and the implementation of principle machine learning algorithms. Topics include supervised and unsupervised learning methods for classification, prediction, and decision making.</p>	3	DSU
<b>CSC 770</b>	<p><b>Software Engineering Management</b></p> <p>Management issues arise in the development of software systems. The topics include planning documentation for requirements, design, implementation and testing, cost projection and modeling, documentation standards, code control, tracking of defects management psychology, group interaction and communication, and the management of reviews and walkthroughs.</p> <p>Prerequisites: CSC 470 or instructor consent.</p>	3	SDSU

## Dissertation

Prefix Number	Course Title	Credit Hours	Location
<b>CSC 804</b> <b>(1)</b>	<b>Cyber Security Research Methodologies</b> This course develops skills needed in quantitative, qualitative and design science research methodologies. Students will acquire skills in the development of research proposals for each of the three methodologies normally used in cybersecurity research.	3	DSU
<b>CSC 809</b> <b>(1)</b>	<b>Dissertation Preparation</b> Students will formalize, present, and defend a dissertation proposal with guidance from a faculty dissertation chair. By working closely with a faculty member, each student should have a developed dissertation proposal in a specific research field of cyber security that it agreed upon by both student and faculty member.	3	DSU
<b>CSC 898</b> <b>D</b>	<b>Dissertation</b> A formal treatise presenting the results of study submitted in partial fulfillment of the requirements for the applicable degree. The process requires extensive and intensive one-on-one interaction between the candidate and professor with more limited interaction between and among the candidate and other members of the committee.	24-30	DSU/SDSU
<b>(1)</b>	<b><i>ONLY DSU students will be required to take as part of 24-30 credits</i></b>		

## Electives:

Prefix Number	Course Title	Credit Hours	Location
<b>CSC 533</b>	<b>Computer Graphics</b> Principles of computer graphics. A study of the algorithms used to generate raster and vector graphics.	3	DSU/SDSU
<b>CSC 547</b>	<b>Artificial Intelligence</b> Introduction to ideas, issues and applications of Artificial Intelligence. Knowledge representation, problem solving, search, inference techniques, theorem proving expert systems. Artificial intelligence programming languages.	3	DSU/SDSU
<b>CSC 574</b>	<b>Computer Networks</b> Analysis of current and future computer networks with emphasis on the OSI model. Local and wide area networks. TCP/IP, SNA, token ring, ethernet and other common networks will be covered. Protocol and interfaces within and across networks including the OSI layers, routers, bridges and gateway.	3	SDSU
<b>MATH 575</b>	<b>Operations Research</b> Philosophy and techniques of operations research, including game theory; linear programming, simplex methods, and duality; transportation and assignment problems; introduction to dynamic programming; and queuing theory.	3	DSU/SDSU
<b>CSC 592</b>	<b>CSC 592 – Topics</b> Includes current topics, advanced topics and special topics. A course devoted to a particular issue in a specified field. Course content is not wholly included in the regular curriculum. Guest artists or experts may serve as instructors. Enrollments are	3	SDSU

	usually of 10 or fewer students with significant one-on-one student/teacher involvement.		
<b>STAT 601</b>	<b>Modern Applied Statistics I</b> This course will build upon STAT 541 and assume students have knowledge of SLR, MLR, ANOVA, and basics of statistical inference. The class will start by covering statistical graphics and the associated modern statistical computing language(s). The next section of the class will focus on non- and semi-parametric methods with a focus on the application and interpretation of the methods. The last section of the class will focus on longitudinal and repeated measure models and conclude with an overview of techniques from meta-analysis and large-scale inference.	3	SDSU
<b>STAT 602</b>	<b>Modern Applied Statistics II</b> This course will start with an introduction to data mining techniques from multivariate data such as Principal Component Analysis, Multidimensional Scaling, and Cluster Analysis. From there we will move on to an introduction to supervised learning methods and pattern recognition with a focus on algorithmic methods. The course will finish with an overview of statistical prediction analysis relevant to business intelligence and analytics.	3	SDSU
<b>CSC 600</b>	<b>Accelerated Computer Science Fundamentals</b> This course teaches the fundamental and advanced techniques of graduate computer programming using C++. The C++ language is used for this course because it is the standard language used for most graduate courses. In this course, students will learn how to write efficient and reliable code through advanced programming techniques.	3	SDSU
<b>CSC 630</b>	<b>Accelerated Computer Science Fundamentals</b> This course teaches the fundamental and advanced techniques of graduate computer programming using C++. The C++ language is used for this course because it is the standard language used for most graduate courses. In this course, students will learn how to write efficient and reliable code through advanced programming techniques.	3	SDSU
<b>INFA 701</b>	<b>Principles of Information Assurance</b> This course covers key bodies of knowledge and specializations in security, privacy, and compliance associated with enterprise information systems. The course explores defense-in-depth techniques of layering people, process and technology controls to secure the enterprise. Topics include information security law, ethics, security concepts and mechanisms; security technologies; authentication mechanisms; mandatory and discretionary controls; basic cryptography and its applications; digital forensics, biometrics database security, intrusion detection and prevention, anonymity and privacy issues for information systems. Emerging frameworks and tools are explored to complete the student's foundational understanding of information assurance.	3	DSU
<b>CSC 716</b>	<b>Secure Software Engineering</b> This course introduces both theoretical and practical approaches to securing software engineering processes. Special attention	3	DSU

	will be paid to requirements elicitation and specification of secure systems, secure software design approaches, secure software development best practices, integration of software components into secure environments and the configuration and execution of software security toolsets. Students will not only be exposed to practical approaches and tools to create and implement secure software, but they will also be exposed to cutting-edge secure software engineering technical research papers. It is expected students have a strong computer science background and are prepared to create, review, audit and exploit software packages.		
<b>INFA 723</b>	<b>Cryptography</b> This course covers fundamentals of cryptography and its applications, classical and contemporary ciphers, encryption and decryption and breaking ciphers. Cryptographic applications, protocols, applications of cryptography and automated tools to analyze cryptographic protocols are examined.	3	DSU
<b>INFS 730</b>	<b>Web Application Development</b> An introduction to client and server-side web programming. Client-side topics include HTML compliance and server-side code will be utilized to create dynamic web sites. There is a substantial programming component in the course.	3	DSU
<b>INFA 735</b>	<b>Offensive Security</b> This course provides theoretical and practical aspects of network and web application penetration testing. The course includes in-depth details and hands-on labs for each phase of an ethical hack including, but not limited to: reconnaissance, vulnerability assessment, exploitation, maintaining access, and covering tracks. An applied approach with a focus on current tools and methodologies will be stressed.	3	DSU
<b>INFS 736</b>	<b>Technology for Mobile Devices</b> This course introduces web pages and style sheets for mobile devices and then focuses on developing applications for various Smartphones, Tablets and other mobile devices.	3	DSU
<b>INFS 750</b>	<b>IT Infrastructure, Technology and Network Management</b> A study of IT Infrastructure, systems, and networks according to the OSI model. Special consideration is given to Internet, Intranet, local and wide area network design, technical requirements, operation, and management.	3	DSU
<b>INFS 760</b>	<b>Enterprise Modeling and Data Management</b> A study of the principles and techniques used in Enterprise Modeling, and Data Management. Topics include the architecture and techniques in designing and implementing enterprise models, database design and implementation technologies.	3	DSU
<b>INFS 764</b>	<b>Information Retrieval</b> Provides hands-on experience with procedural extensions to the SQL language for retrieval and manipulation of data. Topics include data control languages, control structures, looping and branching, local and global variables, exception handling, stored procedures and database triggers, cursors and cursor processing.	3	DSU
<b>INFS 766</b>	<b>Advanced Database</b>	3	DSU

	<p>This course is designed to give the student a strong foundation in the theoretical underpinnings of current database systems. Emphasis will be placed on database theory and will cover such issues as distributed databases, concurrency control, security, optimization, and specialized data models. It will also explore emerging database methodologies and their impact on current practices.</p>		
<b>INFS 768</b>	<p><b>Predictive Analytics for Decision Making</b>  This course provides a broad understanding of the role of predictive analytics for decision-making in different application domains. Students will be exposed to a number of predictive analytics techniques originated in related fields of statistics, machine learning, and artificial intelligence. Techniques covered will include statistical techniques such as linear and logistic regression, classification techniques such as decision trees and neural networks, association analysis techniques such as market basket analysis, and cluster analysis techniques such as K-means clustering. Applications of each of the techniques for decision-making applications will be emphasized. Utilization of predictive analytics software is incorporated.</p>	3	DSU
<b>MATH 773</b>	<p><b>Numerical Optimization</b>  This course will survey widely used methods for continuous optimization, focusing on both theoretical foundations and implementation using numerical software. Topics include linear programming (optimization of a linear function subject to linear constraints), line search and trust region methods for unconstrained optimization, and a selection of approaches (including active-set, sequential quadratic programming, and interior methods) for constrained optimization.</p>	3	SDSU
<b>MATH 774</b>		3	SDSU