COURSE DESCRIPTION

CSE 620. Introduction to Computational Software Tools Credit 3(3-0)

This course covers the introduction and application of commonly used computational tools including computer algebra systems, interpreted languages used as scripting languages, and programming. This course also covers the basics of computational science including finite precision arithmetic, logic, and algorithmic design.

CSE 701. Applied Probability and Statistics Credit 3(3-0)

This course addresses probability and statistics theory and techniques with common application in computational science and engineering. The course will include exploratory data analysis techniques, statistical standard distributions, one-and-two sample tests with continuous data, regression analysis, analysis of variance, analysis of tabular data, sample size calculations, hypothesis testing, linear regression, and design of experiments. Statistical languages such as R will be used to implement the concepts learned in the course.

CSE 702. Computational Methods for Algebraic Systems Credit 3(3-0)

This course presents and discusses computational methods and their reliability, accuracy, and scalability, and computational implementations, with special emphasis on the solution, analysis, and optimization of linear and nonlinear algebraic systems. Topics include computational aspects of matrix theory, solution of large sparse linear systems, matrix decompositions such as the eigenvalue and singular value decompositions, linear and nonlinear programming, and function approximations.

CSE 703. Programming for Scalable Computing Systems Credit 3(3-0)

This course presents the concepts, principles of hardware and software, communication and computational strategies for scalable, parallel computing systems, the associated computer data structures, programming libraries for parallel programming paradigms. This course is to bridge the gap between the parallel algorithms and applications which are often designed and described in abstract terms and the actual parallel computer architectures and their programming interfaces. Prerequisite: CSE 620

CSE 705. Computational Aspects of Linear System Theory Credit 3(3-0)

This course reviews basic concepts from linear systems and considers the computational aspects of modeling, analyzing, controlling, and identifying linear systems. Topics include classification of signals and systems, an overview of system-theoretic problems such as modeling, identification, control, and simulation, linearization, inversion, computations based on discretization and matrix decompositions.

CSE 720. Research Computing Environments Credit 3(3-0)

This course introduces high performance computing environments, ranging from extreme high end desktop systems to scalable computing with clusters and MPP systems. Emphasis is on environments possessing the following elements: the Linux operating system, multi-core and GPGPU combined systems, large storage management, remote execution and schedulers for shared resource management. Prerequisite: Consent of Instructor.

CSE 750. Concepts in Computational Science and Engineering Credit 3(3-0)

This course focuses on computational thinking. The student will learn how to express scientific concepts as a problem for a computer to help solve. The course includes the transformation from infinite-precision mathematics to a discrete approximation which is implemented in code or other appropriate tool for the computer.

CSE 785. Special Topics Credit Credit 3(3-0)

This course is designed to allow the introduction of potential new courses on a trial basis or special content courses on a once only basis at the Master's level. The topic of the course and title are determined prior to registration. Prerequisite: Consent of Instructor.

CSE 750. Topics in Computational Science and Engineering Credit 3(3-0)

This course focuses on computational thinking. The student will learn how to express scientific concepts as a problem for a computer to help solve. The course includes the transformation from infinite precision mathematics to a discrete approximation which is implemented in a code or other appropriate tool for the computer.

CSE 785. Special Topics Credit 3(3-0)

This course is designed to allow the introduction of potential new courses on a trial basis or special content courses on a once only basis at the Master's level. The topic of the course and title are determined prior to registration. Prerequisite: Consent of Instructor.

CSE 792. Graduate Seminar Credit 1(1-0)

Discussions and reports of subjects in Computational Science and Engineering and allied fields will be presented.

CSE 793. Master's Supervised Teaching Credit 3(3-0)

Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of assignment. Prerequisite: Consent of Instructor.

CSE 794. Master's Supervised Research Credit 3(3-0)

This course is supervised research under the mentorship of a faculty member. It is not intended to serve as the project nor thesis topic of the master's student. Prerequisite: Consent of instructor.

CSE 796. Master's Project Credit 3(3-0)

The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project, must be submitted for approval. This course is only available to project option students.

CSE 797. Master's Thesis Credit variable 2 to 6(2 to 6-0)

Science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the Master's Thesis. This course is available only to thesis option students and can be repeated.

CSE 799. Continuation of Master's Thesis Credit 1(1-0)

This course is a continuation of CSE 797. The course is for master's students who have completed all required credit hour requirements. This course is repeatable. Prerequisite: Completion of all Thesis credit hours.

CSE 801. Computational Statistics Credit 3(3-0)

This course covers computational statistical concepts for analyzing large data sets including. Topics include: maximum likelihood, generating random variables, estimating distributions via simulation, expectation-maximization, data partitioning including bootstrapping, jackknifing and cross-validation, multivariate, parametric and non-parametric regression, principal components, classification and regression trees, and multivariate analysis of variance (MANOVA). Statistical packages such as MATLAB will be utilized to implement the concepts learned in the course.

CSE 802. Computational Methods for Differential Equations Credit 3(3-0)

This course presents and discusses computational methods and their reliability, accuracy, and scalability, and computational implementations, with special emphasis on initial and boundary value problems in ordinary and partial differential equations. Topics include sampling issues, discretization and truncation errors, marching, finite differences, finite-elements, grids and meshes, and function approximations.

CSE 803. High-Performance and Scalable Computing Credit 3(3-0)

This course discusses computing paradigms, hardware and software implementations, and communication and computational strategies for high-performance scalable and parallel computing systems; including clusters, grid computing, GPGPU computing and remote

storage. Examples include MPI, OpenMP and GPU libraries for scalable computing and programming on available clusters. Prerequisite: CSE 703 or Consent of Instructor.

CSE 804. Computational Modeling and Visualization Credit 3(3-0)

This course covers some computational techniques for solving deterministic and non-deterministic models followed by analysis and interpretation techniques useful in the analysis of numerical data. The course includes the use of visualization tool kits, such as 3D visualization. Students will analyze the effectiveness of visual representations and construct their own visualizations, strengthening their abilities to explore, evaluate, and understand large amounts of quantitative data. Prerequisite: CSE 620 or Consent of Instructor.

CSE 805. Machine Learning and Data Mining Credit 3(3-0)

This course covers machine-learning and data-mining concepts for analyzing very large, complex data sets. Topics include data preprocessing, measuring data similarity, mining frequent patterns, association rule mining, classification/prediction, cluster analysis, neural-network, decision trees, discriminant analysis, rule-based decisions, nearest-neighbor and naïve Bayes classifier, outlier detection and others. Machine learning tools like WEKA will be introduced to augment the course materials.

CSE 806. Computational System Theory Credit 3(3-0)

This course overs the fundamentals of general, qualitative, and linear system theories such as the classification of signals, models, and systems, and problems of system theory such as simulation, system identification, and inversion. Computational themes such as decomposition, continuation, and prediction-correction are discussed. The computational requirements and complexity of basic algorithms of system theory are also discussed.

CSE 815. Bioinformatics Credit 3(3-0)

This course examines fundamental concepts and methods in bioinformatics, including computational methods for analyzing DNA, RNA, and the protein data, with explanations of underlying algorithms, the advantages and limitations of each method, and strategies for their application to biological problems. Various tools for Next-Generation sequence data analysis are introduced. Prerequisite: Consent of Instructor.

CSE 816. Topics in Multi-Scale and Multi-Physics Modeling Credit 3(3-0)

This course focuses on multi-scale, multi-physics modeling approaches, associated computational techniques involving quantum, atomistic, micro-level, meso-level, macro-level models and the coupling of such models and related applications in engineering, materials and physical sciences.

CSE 817. Fundamentals of Big Data Analysis Credit 3(3-0)

This course covers the concepts of big data analysis such as variety, velocity, veracity, and value. The course focuses on issues of storage, processing, analysis, visualization and application of big data. Technologies such as MapReduce and Hadoop are discussed, in addition to the newest trends. Prerequisite: Consent of Instructor.

CSE 826. Modeling and Simulation of Physical Systems Credit 3(3-0)

This course applies computational methods to design and implement models for a variety of physical systems that are based on the continuum or particle paradigms. Both deterministic and stochastic approaches are presented. Example applications include satellite trajectories, acoustics, and electro-magnetic fields. Implementations using high-end scalable computing will be pursued. Prerequisite: CSE 620 or Consent of Instructor.

CSE 885. Special Topics Credit 3(3-0)

This course is designed to allow the introduction of potential new courses on a trial basis or special content course as required at the doctoral level.

CSE 992. Doctoral Seminar Credit 1(1-0)

Seminars delivered by student researchers, faculty, and invited speakers. The student receives a Pass/Fail and no letter grade is given upon completion. This course can be taken more than once

CSE 993. Doctoral Supervised Teaching Credit variable, 2-3(2/3-0)

This course introduces the doctoral student to classroom or laboratory teaching under the supervision of a faculty mentor. Prerequisite: Consent of Instructor.

CSE 994. Doctoral Supervised Research Credit variable, 2-3(2/3-0)

This is supervised research under the mentorship of a member of the graduate faculty. It is not intended to serve as the dissertation topic of the doctoral student. Prerequisite: Consent of Instructor.

CSE 997. Doctoral Dissertation Credit variable, 2 to 12 (2 to 12-0)

This represents the supervised research leading to the dissertation for the doctoral student. This course is repeatable. The student receives a Pass/Fail grade only after the completion of the final PhD oral defense.

CSE 999. Continuation of Dissertation Credit 1(1-0)

This course is for doctoral students who have completed all required credit hour requirements. This can be repeated by the students as required. The student receives a Pass/Fail and no letter grade given upon completion. This course can be taken repeatedly.