Computer Science

TENNESSEE TECH

PhD Curriculum

Each PhD student is required to develop and submit a Program of Study before the beginning of the second semester of study. The student prepares this program of study in consultation with his/her Advisory Committee. The student's advisory committee, the CS Chair, the Assoc. Dean for Graduate Studies, and the VP of Graduate Studies must approve the program of study. The PhD Program of Study shall include CS 6910 and a minimum of 18 credits of coursework beyond the Master's degree or 43 credits of coursework beyond the Bachelor's degree. The Program of Study shall also include a minimum of 24 credits of Research & Dissertation, as well as any background, graduate-level courses taken prior to enrollment in the Ph.D. program. If the student has not taken at least 24 credits of appropriate MS courses (as determined by the advisory committee), the student will be required to take additional MS courses. No more than 9 credits of Independent/Directed Study courses are permitted. Twelve credits must be at the 7000-level. The Program of Study must be approved by the student's advisory committee, the department chairperson, the Associate Dean of Engineering for Graduate Studies and Research, and the Associate Vice President for Research and Graduate Studies.

PhD Comprehensive Exam and Admission to Candidacy

The PhD comprehensive examination will consist of an exam and a written and oral presentation of the Research Proposal. The examination will be formulated by the advisory committee, as appropriate to the student's area of research. This examination will test the student's breadth of knowledge across the discipline, depth of knowledge in the research area, and the ability to integrate the knowledge acquired from several courses. This examination is given after the student has completed most of the coursework prescribed in the program of study. It must be completed within one semester following completion of all coursework in the program of study. All parts of the comprehensive examination should be completed within a period of two weeks. The details of this examination, including format, content, method of evaluation and timing, will be left to the discretion of the committee. All voting members of the committee should participate in evaluating the student's performance in the examination. The research proposal should consist of the development of the research problem from the extant knowledge in the area, the approach and methodology to be followed, the expected original contribution to the extant knowledge and the expected time-line for the completion of the research. The student should submit copies of written proposal to the committee at least two weeks before the oral proposal presentation. The student will be informed of the results of the entire comprehensive examination at the end of the defense of the research proposal.

On passing the comprehensive exam, the student is admitted to candidacy for the doctoral degree. A student not passing any part of the comprehensive examination will be

given a second chance to pass the part of the examination that he/she did not pass. The committee may prescribe additional academic work to be undertaken by the student prior to making the second attempt. No student will be permitted to continue in the PhD program if he/she does not successfully complete all parts of the comprehensive examination after the second attempt.

Dissertation Defense

A fundamental milestone in the graduation requirements is completion of the Oral Defense, which consists of an oral presentation by the student of her/his dissertation research results, followed by questioning. The overall intention is to test the breadth of knowledge in the discipline, depth in the specific area of research and ability to integrate concepts and techniques learned in the various courses. Students should schedule the dissertation defense date well in advance to insure that all members of their committee are in attendance. Students must submit a draft copy of their dissertation to their committee and to Graduate Studies at least two weeks before the defense date. The defense begins with an open session in which the candidates make a presentation to their committee and other faculty and students. The audience then asks the candidate questions regarding their research work. Afterward, in a closed session, the committee examines the candidate on the details of their thesis, as well as any other relevant material. Then the candidate is asked to leave the room, and the committee discusses the candidate's performance and then votes to pass or fail the candidate. The student must pass this examination by three (3) positive votes or three-fourths of the committee members eligible to vote. A signature form is then forwarded to Graduate Studies with the results of the examination. If the candidate passes the exam, the committee instructs the candidate on any required changes or new work needed to complete their thesis. If the candidate fails the exam, the committee informs the candidate in writing regarding the additional work that the candidate must undertake before taking the examination a second time. The second attempt may be scheduled as soon as these deficiencies are rectified. However, failure on the second attempt results in dismissal from the graduate program. The requested revisions to the dissertation must be made, final signatures of all committee members obtained, and the Final Dissertation must be electronically uploaded to the office of Graduate Studies at least one week before graduation.

CSC 7730: Autonomic Computing

Catalog Description: This course introduces graduate students to principles, key concepts, and proposed methodologies underlying the design and engineering of autonomic computing and networking (AC) systems of autonomic computing systems. The course investigates the origins, goals, and promises of autonomic computing. The course content includes complexity of autonomic computing, architecture, algorithms, enabling technology and development tools for autonomic computing.

Potential Text: Richard Murch, Autonomic Computing, IBM Press, 2004, Prentice Hall and Selected Research papers

Pre requisite(s): CSC 6780 or CSC 6730

Topics:

Week 1	Autonomic attributes
Week 2	Complexity in autonomic computing and its forms.
Week 3, 4	Architectures
Week 5, 6	Applications
Week 7	Algorithms for autonomic applications
Week 8	Fault Tolerance
Week 9, 10, 11	Resource Management
Week 12	Open standards, implementation considerations,
Week 13, 14	Enabling technology and development tools

Grade components:

Readings and presentations	25%
Projects	25%
Exams	25%
Term Paper	25%

Grading scale:
A – 90-100
B – 80-89
C – 70-79
D – 60-69
F – Below 60

Students with disabilities: Students with a disability requiring accommodations should contact the Office of Disability Services (ODS). An Accommodation Request (AR) should be completed as soon as possible, preferably by the end of the first week of the course. The ODS is located in the Roaden University Center, Room 112; phone 372-6119.

CSC 7575: Security Topics in the Smart Grid

Course Description

The North American electric power grid is evolving into an interactive, dynamic grid with critical need for efficiency, reliability, and security improvements. This course will introduce students to timely topics related to security issues, concerns and trends in the modern power grid. We will discuss threats of and protection for the IT/computer layer of the seven smart grid conceptual framework domains such as bulk generation, customer, distribution, markets, operations, service provider, and transmission. Also, we will look at security initiatives and the federal, state, and local level as related to the Smart Grid.

Prerequisites: Graduate standing in Computer Science or Electrical and Computer Engineering, or approval of instructor.

Course Topics:

Week 1. Introduction to the Smart Grid and its Conceptual Framework Domain
Week 2. Threat Overview for Seven Domains
Week 3. Security Standards applicable to the Smart Grid
Week 4. Automatic Meter Reading: Threats and protection
Week 5. Utility Companies: Threats and protection
Week 6. Smart Meters: Threats and protection
Week 7. Smart Devices: Threats and protection
Week 8. Third Party Service Providers: Threats and protection
Week 9. Mobile Applications: Threats and protection
Week 10. Mobile Devices: Threats and protection
Week 11. Wide Area Monitoring Services: Threats and protection
Week 12. Industrial Control systems in general: Threats and protection
Week 13. Industrial Control systems: SCADA: Threats and protection
Week 14. Global, Federal, State, and Local Efforts in Smart Grid protection

Readings: Selected textbook chapters, numerous journal articles and conference papers in the field.

Potential textbook: *Securing the Smart Grid: Next Generation Power Grid Security* by Tony Flick and Justin Morehouse, Elsevier and Syngress, 2010.

Grading Policy:

A: 90-100
B: 80-89
C: 70-79
D: 60-69
F: <60

CSC 7210: Anomaly and Intrusion Detection Systems

Course description: This course covers traditional intrusion and anomaly detection systems, as well as current advances in this ever-growing field. The application of anomaly detection to a wide-range of domains, including fraud, insider threats, and time-series data will be investigated in-depth, as well as network attacks and the systems for detecting oddities such as network intrusions and denial of service attacks. This course will not only cover the subjects through readings, but also through hands-on experience.

Prerequisite(s): CSC 6220 or CSC 6230

Possible textbook(s):
None. Required readings and slide presentations are chosen from openly available content on the internet. They will be stored locally on the instructor's web-site for convenience.

Course topics by week:
Week 1: Overview of Course
Week 2: Current Systems and Issues
Week 3: Networks
Week 4: Intrusion Detection Systems (IDS)
Week 5: Supervised Anomaly Detection
Week 6: Unsupervised Anomaly Detection
Week 7: Worms and Denial of Service
Week 8: Insider Threats
Week 9: Graph-based Anomaly Detection
Week 10: Time-series data
Week 11: Security
Week 12: Telecommunications
Week 13: E-Commerce/Healthcare
Week 14: Wrap-up

Grade components:
Readings and presentations 25%
Project 1 20%
Project 2 25%
Project 3 30%

Grading scale:
A – 90-100
B – 80-89
C – 70-79
D – 60-69
F – Below 60

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CSC 7720: Distributed Operating Systems

Course Description: This course covers computer operating systems that run on multiple, independent central processing units but appear to the user as an ordinary centralized operating system. In particular, this course covers the principles, design, and implementation of distributed operating systems, including network technologies, synchronization, distributed resource management, distributed process management, security, and distributed file systems.

Possible Textbooks:
Distributed Operating Systems: Concepts and Design, Pradeep K. Sinha
Distributed Systems: Principles and Paradigms, Andrew S. Tanenbaum and Maarten van Steen

Prerequisite: CSC 6720

Course topics by week:

Week 1:	Fundamentals.
Week 2:	Computer Networks.
Week 3:	Message Passing.
Week 4:	Remote Procedure Calls.
Week 5:	Distributed Shared Memory.
Week 6:	Consistency and Replication.
Week 7:	Synchronization.
Week 8:	Resource Management.
Week 9:	Process Management.
Week 10:	Distributed File Systems.
Week 11:	Naming.
Week 12:	Security.
Week 13:	Case Studies
Week 14:	Case Studies/Presentations

Grade components:

Presentations	20%
Exams (2)	50%
Projects (3)	30%

Grading scale:

A – 90-100
B – 80-89
C – 70-79
D – 60-69
F – Below 60

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CSC 7240: Intelligent Information Systems

Catalog Description: Prerequisite: CSC 6220 or CSC 6230. This course combines fundamental research in artificial intelligence with application-oriented research in knowledge discovery, decision-support systems, and adaptive computing.

Text: Readings from research literature

Prerequisite(s): CSC 6220 or CSC 6230

Topics
Machine learning
Data mining
Knowledge representation
Informatics
Semantic web
Decision support systems
Adaptive computing
Data fusion

Grade components:

Readings and presentations	40%
Projects	60%

Grading scale:
A – 90-100
B – 80-89
C – 70-79
D – 60-69
F – Below 60

Students with disabilities: Students with a disability requiring accommodations should contact the Office of Disability Services (ODS). An Accommodation Request (AR) should be completed as soon as possible, preferably by the end of the first week of the course. The ODS is located in the Roaden University Center, Room 112; phone 372-6119.

CSC 7750: High Performance Computing

Catalog Description: This course introduces graduate students to principles, key concepts, and proposed methodologies used in advanced high performance computing. The future of high performance computing is in exploiting the ever-increasing levels of parallelism. This course will investigate the origins, goals, and techniques of these distributed and parallel systems. The course content will include the architecture, algorithms, techniques, and enabling technology and development tools for high performance computing.

Potential Text: High Performance Computing: Programming and Applications, John Levesque with Gene Wagenbreth, CRC Press, ISBN: 978-1-4200-7705-6. Programming specific texts may be offered as additional optional texts.

Pre requisite(s): CSC6750

Topics

Week 1	Architectures
Week 2	Architectures
Week 3	Compilers
Week 4	Programming Paradigms
Week 5	Programming Paradigms
Week 6	Programming Paradigms
Week 7	Programming Paradigms
Week 8	Optimization
Week 9	Resilience
Week 10	Resilience
Week 11	Parallelism factors
Week 12	Performance factors
Week 13	Accelerators
Week 14	Accelerators

Grade components:

Readings and presentations	25%
Projects	25%
Exams	25%
Term Paper	25%

Grading scale:
A – 90-100
B – 80-89
C – 70-79
D – 60-69
F – Below 60

Students with disabilities: Students with a disability requiring accommodations should contact the Office of Disability Services (ODS). An Accommodation Request (AR) should be completed as soon as possible, preferably by the end of the first week of the course. The ODS is located in the Roaden University Center, Room 112; phone 372-6119.