The University of Georgia

Department of Computer Science

Course Information Sheet

CSCI 4150

Numerical Simulations in Science and Engineering

Brief Course Description (50-words or less)	Computationally oriented, covering a wide range of topics that are necessary for numerical simulation in science and engineering. Sequential and parallel numerical methods will be introduced. Available symbolic and numerical software packages (e.g., Matlab, Maple and MPI) and visualization tools will be used in the mathematical simulations.
Extended Course Description / Comments	N/A
Pre-Requisites and/or Co-Requisites	Course in calculus and/or knowledge of a programming language
Required, Elective or Selected Elective	Selected Elective Course
Approved Textbooks (if more than one listed, the textbook used is up to the instructor's discretion)	Instructor uses his/her own notes
Specific Learning Outcomes (Performance Indicators)	This course presents topics in numerical methods for students studying computer science and/or engineering. At the end of the semester, all students will be able to do the following: 1. Use Taylor series and symbolic available software to find finite difference formulas for one and higher order derivatives. 2. Discretize ordinary differential equations (ODEs) by finite difference methods and solve them. 3. Distinguish between explicit and implicit methods for solving ODEs. 4. Use Fourier transform to solve simple ODEs and PDEs. 5. Use Galerkin finite element method for solving two point boundary value problem. 6. Differentiate between different classifications of computer systems. 7. Map a problem on different high performance systems. 8. Calculate speedup and efficiency of parallel algorithms. 9. Use visualization tools to study the results and draw a conclusion on the solution.

Relationship Between Student Outcomes and Learning Outcomes

		Student Outcomes										
		a	b	c	d	e	f	g	h	i	j	k
Learning Outcomes	□	●	●							●		
	□	●	●							●		
	□	●	●									
	□	●	●							●		
	□	●								●		
	6	●										
	7	●	●							●		
	8	●										
	9		●							●		

Major Topics Covered
(Approximate Course Hours)

3 credit hours = 37.5 contact hours
4 credit hours = 50 contact hours

Note: Exams count as a major topic covered

1. Introduction to scientific computing and numerical (3 hours) simulations
2. Finite difference methods (5 hours)
3. Introduction to finite element methods (5 hours)
4. Finite Fourier methods (4 hours)
5. Symbolic computation (3 hours)
6. Introduction to higher performance computing (4 hours)
7. Classification of computer systems (3 hours)
8. Speedup and efficiency (2hours)
9. Visualization tool (3 hours)
10. Mathematical models and implementation (12 hours)
11. Exams (6 hours)

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