School of Computing
UNIVERSITY OF GEORGIA

Course Information Sheet
CSCI 4150/6150
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) and visualization tools will be used in the mathematical simulations.
Extended Course Description / Comments	
Pre-Requisites and/or Co-Requisites	Prerequisite: (MATH 2250 and CSCI 1301-1301L) or Permission of Department
Approved Textbook	Author(s): Ward Cheney, David Kincaid, and the instructor's notes Title: Numerical Mathematics and Computing Edition: Seventh Edition
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. Know number systems and number representations in a computer. 2. Use Taylor series and symbolic available software to find finite difference formulas for one and higher order derivatives. 3. Discretize ordinary differential equations (ODEs) and partial differential equations (PDEs) by finite difference methods and solve them. 4. Distinguish between explicit and implicit methods for solving ODEs and PDEs. 5. Use different methods to solve linear systems. 6. Use Matlab to solve differential equations (ODEs and PDEs) and to implement numerical formulas. 7. Use high-performance systems like CUDA for parallel computing. 8. Calculate speedup and efficiency of parallel algorithms. 9. Use visualization tools to study the results and draw a conclusion on the solution.
ABET Learning Outcomes	A. Graduates of the program will have an ability to: Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions. B. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline. C. Communicate effectively in a variety of professional contexts.

D. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
E. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
F. Apply computer science theory and software development fundamentals to produce computing-based solutions.

NOTE: In the construction of the student learning outcomes for this course, the instructors interpreted "computing requirements" in (B) as the functional requirements for a software solution and not as specific hardware requirements for the target platform; likewise, the phrase "apply computer science theory" in (F) was interpreted as using computer science principles.

Relationship Between Student Outcomes and Learning Outcomes

		ABET Learning Outcomes					
		A	B	C	D	E	F
Specific Learning Outcomes	1	●					
	2	●					
	3	●	●				●
	4	●					
	5	●	●				●
	6	●	●				●
	7	●	●				
	8	●					
	9	●	●				●

Major Topics Covered

1. Introduction to scientific computing and numerical simulations (1 hour)
2. Introduction to Matlab and Maple (2 hours)
3. Number systems and number representations (4 hours)
4. Taylor series (5 hours)
5. Symbolic computation (3 hours)
6. Initial value problems and systems of ODEs (6 hours)
7. Boundary-value problems and Linear Systems (12 hours)
8. Partial differential equations (6 hours)
9. Parallel computing, speedup and efficiency (4 hours)
10. Visualization tool (2 hours)
11. Mathematical models and implementation (2 hours)
12. Exams (3 hours)

A number of mathematical models for problems in science and engineering will be discussed and numerical solutions for them will be implemented. Available symbolic and numerical computational packages (such as Matlab, Maple) and visualization tools will be used in the simulations.

How Data is Used to Assess Program Outcomes

Each Learning Outcome, listed above, directly supports one or more of the Program Outcomes, as is listed in "Relationships between

	Learning Outcomes and Program Outcomes". For CSCI 4150/6150, Program Outcomes (A), (B), and (F) are supported.
Course Master	Dr. Yi Hong Modified on 2/23/2024 by Sal Lamarca.