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 visualization tools will be used in the mathematical simulations.

Extended Course Description / Comments

Use this section to put additional information that's relevant to whom this course is targeting

Pre-Requisites and/or Co-Requisites

Course (MATH 2250, CSCI 2150 and 1301) OR POD

Approved Textbooks
(If more than one, course text used during a semester is at the discretion of the instructor)

Author(s): Ward Cheney, David Kincaid, and my own notes
Title: Numerical Mathematics and Computing
Edition: Seventh Edition
ISBN-13:

Specific Learning Outcomes (Performance Indicators)

These are a (non-exhaustive) list of specific, measurable outcomes, as they relate to the course & program objectives.

These learning outcomes should avoid using ambiguous language such as "understand" or "familiar".

Performance indicators must include an action verb (indentifying the depth to which students should demonstrate performance), and the content referent that is the focus of the instruction (from ABET)

Target number 5 - 10

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.

Relationship Between Course Outcomes and Learning Outcomes

Learning Outcomes	*Program Outcomes*										
	a	b	c	d	e	f	g	h	i	j	k
1	x										
2	x	x							x		
3	x	x							x		
4	x	x							x		
5	x								x		
6	x								x		
7	x	x							x		
8	x										
9		x							x		

Program Outcomes

(These are ABET-specified and should not be changed)

a. An ability to apply knowledge of computing and mathematics appropriate to the discipline.
b. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
c. An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
d. An ability to function effectively on teams to accomplish a common goal.
e. An understanding of professional, ethical, legal, security and social issues and responsibilities.
f. An ability to communicate effectively with a range of audiences.
g. An ability to analyze the local and global impact of computing on individuals, organizations, and society.
h. Recognition of the need for and an ability to engage in continuing professional development.
i. An ability to use current techniques, skills, and tools necessary for computing practice.
j. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
k. An ability to apply design and development principles in the construction of software systems of varying complexity.

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 simulations (1 hours) 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.
Assessment Plan for this Course	Each time this course is offered, the class is initially informed of the Course Outcomes listed in this document, and they are included in the syllabus. At the end of the semester, an anonymous survey is administered to the class where each student is asked to rate how well the outcome was achieved. The choices provided use a 5-point Likert scale containing the following options: Strongly agree, Agree, Neither agree or disagree, disagree, and strongly disagree. The results of the anonymous survey are tabulated and results returned to the instructor of the course. The course instructor takes the results of the survey, combined with sample student responses to homework and final exam questions corresponding to course outcomes, and reports these results to the ABET committee. If necessary, the instructor also writes a recommendation to the ABET committee for better achieving the course outcomes the next time the course is offered.
How Data is Used to Assess Program Outcomes	Each course 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, Program Outcomes (a) and (i) are supported.
Course Master	Dr. Yi Hong
Course History	