CSCI 4150/6150: Numerical Simulations in Science and Engineering

Spring Semester 2015
Syllabus

INSTRUCTOR: Dr. Thiab R. Taha, e-mail: thiab@cs.uga.edu

OFFICE: Boyd Graduate Studies Research Center, Room 412

OFFICE HOURS: T, Th 11:00 AM - 11:50 AM, GSRC 412

PREREQUISITE: (MATH 2250 and CSCI 1301-1301L) or Permission of Department

Credit Hours: 4 hours

LECTURES: 03M/72 T, TH, Boyd GSRC, Room 306

TOPICS COVERED:

This course is computational oriented. The topics to be covered are:

1. Introduction to scientific computing and numerical simulations
2. Number Systems, computer arithmetic, and errors.
3. Numerical methods for solving Initial and Boundary Value Problems of Differential Equations.
4. Numerical methods for solving Partial Differential Equations.
5. Symbolic computation
6. Introduction to high performance computing
7. Classification of computer systems
8. Speedup and efficiency
9. Introduction to parallel algorithms for solving numerical problems using MPI and CUDA for GPUs.
10. Visualization tool

Available symbolic and numerical computational packages (such as Matlab, Maple, MPI, and CUDA) and visualization tools will be used in the simulations.

TEXT: Numerical Mathematics and Computing (Seventh Edition) by Ward Cheney and David Kincaid. Additional topics will be discussed in class.

LEARNING OUTCOMES: 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 differential equations by finite difference methods and solve them.
3. Distinguish between explicit and implicit methods for solving ODEs and PDEs.
4. Use Fourier transform to solve simple ODEs and PDEs.
5. Differentiate between different classifications of computer systems.
6. Map a problem on different high performance systems.
7. Calculate speedup and efficiency of parallel algorithms.
8. Use visualization tools to study the results and draw a conclusion on the solution.

HOMEWORK AND READING: Will be assigned to help you understand the material. Homework will be collected in lectures.

GRADING:

- Exam1 20% (Tentative date: 02/17/2015)
- Exam2 20% (Tentative date: 04/02/2015)
- Final Exam 30%
- Homeworks 30%

Graduate students will be asked to do extra problem(s) on the tests and homework and/or a project.

MAKE UP TESTS: No makeup tests.

Unexcused test absences result in a score of zero for the missing test. Excused absences require extenuating circumstances and advance notice; the missing grade will be replaced by the Final Exam grade.

All adjustments to any grade must be made within 3 days of the work being returned in class. Absolutely no adjustments and no late work will be accepted after the last class period.

Note: The course syllabus provides a general plan for the course; deviations may be necessary.

ACADEMIC HONESTY: All students are responsible for maintaining the highest standards of honesty and integrity in every phase of their academic careers. The penalties for academic dishonesty are severe and ignorance is not an acceptable defense. The Department Policy applies: see overleaf. **(OVER)**