COURSE TITLE: Introduction to Computational Science and Engineering

UNIVERSITY: Clemson University

UNIVERSITY COURSE NUMBER: CPSC 455/655

CREDITS GIVEN AT THE UNIVERSITY: 3

NUMBER OF LECTURE HOURS: 45 lectures at 50 minutes each

DAYS CLASS MEETS ON CAMPUS: 3

TERM NORMALLY OFFERED ON CAMPUS: Spring

INSTRUCTOR:

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ACADEMIC CONTACT PERSON:

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PREREQUISITES: The course assumes the preparation of a senior in computer science, engineering, mathematical sciences, or physical science. At a minimum, the student has had a college level course in physics, at least one year of calculus, one semester of linear algebra. A course in numerical analysis is *not* required (or desirable).

TEXTBOOK: None. Course is note based. Notes are machine readable and available free through the Internet.

COURSE OBJECTIVES: Computational science and engineering (CSE) is the conduct of engineering and science using the computer as an integral tool. CSE emphasizes a multidisciplinary approach to problem solving. CSE at its roots must study three aspects of modeling: the *application*, the appropriate *algorithms*, and the appropriate *architectures* for solution. The course objectives are to introduce the student to these tenets. Students work in groups using computer communications as much as possible. The course requires use of resources found on the net, *e.g., Netlib*. The course is project oriented.

COURSE REQUIREMENTS:

HOMEWORK: some individual homework is required.

Examinations: Examinations are written and oral project reports.

Computer Languages: C or Fortran knowledge assumed commensurate with the student's major (occupation).

Computer Facilities: Workstation (preferred) or PC. Net access.

Laboratory: none.

Projects: Three or four per semester.

COURSE OUTLINE BY TOPICAL AREA

Course Content	Class Periods
Introduction to computational science	1
Introduction to floating point arithmetic	3
Introduction to conditioning analysis	3
Introduction of network resources	1
Review of Taylor series	2
Visualization Techniques	3
Introduction to Maple	2
Case study: Machine parameters	1
Case study: Correct computation in ill-conditioned circumstances: The world on a string.	8
Case study: Numerical solutions of Differential equations: Designing a roller coaster	8
Case study: Optimal control problem: How wrong is your grandfather's clock?	8
Student presentations of case study results	3
Midterm and Final Exams	2
	45