Course Information Sheet
CSCI 4140
Numerical Methods and Computing

Brief Course Description
(50-words or less)

Numerical methods and computing. Topics include: computer arithmetic; numerical solutions of nonlinear equations; polynomial interpolation; numerical differentiation and integration; numerical solutions of systems of linear equations, initial and boundary value problems, systems of ordinary differential equations, spline functions, and the method of least squares.

Pre-Requisites and/or Co-Requisites

CSCI 1302 (Pre-Requisite)
Software Development in Java

MATH 2250 (Pre-Requisite)
Calculus I

MATH 3000 (Co-Requisite)
Introduction to Linear Algebra

Approved Textbooks
(if more than one listed, the textbook used is up to the instructor's discretion)

Author(s): Ward Cheney and David Kincaid
Title: Numerical Methods and Computing
Edition: Fifth Edition
ISBN-13: 0-534-8993-7

Specific Learning Outcomes
(Performance Indicators)

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

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. Distinguish between representations of real and integer numbers inside the computer memory.
2. Solve nonlinear equations by using various numerical methods such as the Newton's method.
3. Interpolate table of values by using polynomial interpolation.
4. Find integration of functions by numerical methods such as Simpson's method as an example.
5. Find first and higher derivatives by using finite difference methods.
6. Solve linear system of equations by Gaussian elimination.
7. Solve first and second order initial and boundary value problems by using various numerical methods such as the RK method.
8. Solve systems of ordinary differential equations by the RK method.

Relationship Between Student Outcomes and Learning Outcomes

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

Student Outcomes

Student Outcomes

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

Computer Arithmetic (4-hours)
Sources of errors (2-hours)
Numerical solutions of nonlinear equations(4-hours)
Polynomial interpolation(2-hours)
Numerical differentiation (3-hours)
Numerical integration: Trapezoid method, Simpson's and quadrature rules(3-hours)
Numerical solutions of systems of linear equations(8- hours)
Initial and boundary value problems(10 hours)
Systems of ordinary differential equations(4 - hours)
Spline functions (1hour)
The method of least squares(1-hour)
Exams (6-hours)

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 Student Outcomes, as is listed in "Relationships between Learning Outcomes and Student Outcomes". For CSCI 4140, Student Outcomes (a), (b), and (i) are supported.

Course Master

Dr. Thiab Taha

Course History

08/1998	Course Loaded into CAPA
02/2012	Course Information Sheet Created
04/2012	Change Pre-Req from MATH 2210-L to MATH 2250