CSCE 564: Computational Science

1. Course number and name: CSCE 564: Computational Science

2. Credit: 3-hrs; Contact: 3 lectures of 50 minutes each or 2 lectures of 75 minutes each per week

3. Instructor: Hu

4. Textbook: Parallel Programming: for Multicore and Cluster Systems by:Thomas Rauber (Author), Gudula Rünger (Author) Publisher: Springer; 1st Edition. edition (March 10, 2010) ISBN-10: 364204817X ISBN-13: 978-3642048173

5. Specific course information
   a. Catalog description: Parallel algorithms; scientific visualization; techniques for solving scientific problems.
   b. Prerequisites: MATH 526, CSCE 146 or 207 or 500
   c. Elective Course

6. Specific goals for the course
   a. Learning Outcomes: Specific outcomes of instruction are that students will be able to:
      - To develop an understanding of the concepts in parallel computing architure/hardware
      - To develop an understanding of major parallel programming models
      - To be able to identify promising applications of parallel computing
      - To be able to develop typical parallel algorithms and implement prototype parallel programs using MPI and OpenMP
      - To be able to analyze the performance of parallel programs
   b. As an elective this course cannot be counted upon to contribute to the attainment of any student outcome

7. Topics covered and approximate weight (14 weeks, 4 hours/week, 56 hours total)
   - Introduction to Parallel Computing
   - PBS and Linux cluster
   - Parallel Architecture
   - Parallel Programming Model
   - Parallel Programming Model and algo design
   - MPI Parallel Programming

- MPI programming functions
- Parallel Programming Send Receive.
- Performance analysis of parallel programs
- Differential Equations
- Maxtrix vector multiplication
- Open-MP programming
- Open-MP/MPI mixed programming
- Multi-thread programming
- Solving Linear Systems

Computer Engineering

Relation of Course Outcomes to EAC Student Outcomes*

Course Outcomes (CE)	Student Outcomes											
	(a) apply knowledge of mathematics, science, and engineering	(b) design and conduct experiments, … interpret data	(c) design a system, component, or process to meet desired needs …	(d) function on multidisciplinary teams	(e) identify, formulate, and solve engineering problems	(f) an understanding of professional and ethical responsibility	(g) communicate effectively	(h) the broad education to understand the impact of engineering solutions …	(i) a recognition of the need for, and an ability to engage in life-long learning	(j) a knowledge of contemporary issues	(k) use the techniques, skills, and modern engineering tools ….	(CE) demonstrate knowledge of discrete mathematics [CE]
Criteria	a	b	c	d	e	f	g	h	i	j	k	CE
1. Solve problems using a computer	2	1	2		3	1		1	2	1	3	1
2. Read and design algorithms	1	2	3		1						2	1
3. Design data structures	1	1	3		1						2	1
4. Demonstrate the ability to use a software development environment to construct, execute, test, and debug software	1	1	2		2						3	
5. Demonstrate the ability to program a computer in a high-level language	1		2		1						3	

* 3 = major contributor, 2 = moderate contributor, 1 = minor contributor; blank if not related

c.

Computer Science & Computer Information Systems

Relation of Course Outcomes to CAC Student Outcomes*

Course Outcomes (CS & CIS)	Student Outcomes											
	All									CS		CIS
	(a) apply knowledge of computing and mathematics appropriate to the discipline	(b) analyze a problem, and identify and define the computing requirements …	c) design, implement, and evaluate a computer-based system, …	(d) function effectively on teams to accomplish a common goal	(e) An understanding of professional, ethical, legal, … responsibilities	(f) communicate effectively with a range of audiences	(g) analyze the local and global impact of computing on … society	(h) Recognition of the need for … continuing professional development	(i) current techniques, skills, and tools necessary for computing practice	(j) apply mathematical foundations, algorithmic principles, and CS theory …	(k) apply design and development principles	(j) An understand processes that support the information systems environment.
Criteria	a	b	c	d	e	f	g	h	i	j	k	j
1. Solve problems using a computer	2	3	2				1	1	2	2	3	2
2. Read and design algorithms	1	3	2						2	2	3	
3. Design data structures	1	2	2						2	2	3	
4. Demonstrate the ability to use a software development environment to construct, execute, test, and debug software	1	2	3						3		2	1
5. Demonstrate the ability to program a computer in a high-level language	1	1	2						3	1	2	

* 3 = major contributor, 2 = moderate contributor, 1 = minor contributor; blank if not related