INTRODUCTION TO PARALLEL PROGRAMMING
HPC 2400

Class Hours: 3.0
Laboratory Hours: 3.0
Credit Hours: 4.0
Date Revised: Spring 03

NOTE: This course is not designed for transfer credit.

Catalog Course Description:
Parallel computing fundamentals including models of parallel computing, architecture taxonomy, memory architecture, performance, design, and scalability considerations, parallel programming paradigms, techniques and issues in parallel program creation and parallel programming examples.

Entry Level Standards:
College level reading and math skills; keyboarding skills of at least 20 wpm; familiarity with computer architecture and competent in at least one high-level programming language and basic knowledge of UNIX or Windows operating system

Prerequisites:
HPC 1010 (NETW 2530) or consent of instructor

Textbook(s) and Other Reference Materials Basic to the Course:
Vipin Kumar, Ananth Grama, Anshul Gupta and George Karypis; Introduction to Parallel Computing; The Benjamin/Cummings Publishing Company, Inc.
Barry Wilkinson, C. Michael Allen; Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers; Prentice Hall

I. Week/Unit/Topic Basis:

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<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
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<tr>
<td>2</td>
<td>Taxonomy of Parallel Architectures</td>
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<td>3</td>
<td>Taxonomy of Parallel Architectures</td>
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<td>4</td>
<td>Interconnection Networks</td>
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<td>5</td>
<td>Performance Metrics for Parallel Systems</td>
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<tr>
<td>6</td>
<td>Effects of Granularity, Data Mapping and Communication Overheads</td>
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<td>7</td>
<td>Scalability of Parallel Systems</td>
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II. Course Objectives*

A. Analyze different parallel architecture and parallel programming alternatives available in getting hardware and software. II III IV

B. Demonstrate through group discussion how to approach a problem and come up with different solutions. IV V

C. Use search tools, inquiries, and on-line resources on the Internet to locate, use, download, upload and communicate effectively. I II III

D. Develop skills to analyze parallel system using performance, scalability and design parameters. I II III IV

E. Demonstrate individual and teamwork standards to complete assigned tasks. III V

F. Develop skills to understand, use and analyze wide variety of parallel tools, and applications. I II III IV

G. Demonstrate efficiency in evaluating different parallel models of computations. I II

H. Implement and apply current developments in the field of high performance computing. I III

*Roman numerals after course objectives reference goals of the HPC program.

III. Instructional Processes*

Students will:

1. Develop an ability to analyze parallel architectures, programming paradigms and applications. Communication Outcome, Technological Literacy Outcome, Information Literacy Outcome, Problem Solving and Decision Making Outcome, Transitional Strategy, Active Learning Strategy

2. Demonstrate skills to evaluate performance, design and scalability parameters associated with parallel systems. Problem Solving and Decision Making Outcome, Technological Literacy Outcome, Information Literacy Outcome, Active Learning Strategy
3. Produce a fully working end-product as part of a collaborative effort for sharing with other class members. Communication Outcome, Transitional Strategy, Active Learning Strategy

4. Use the Internet as a medium for obtaining documentation and instruction and for submitting assignments. Communication Outcome, Technological Literacy Outcome, Information Literacy Outcome, Transitional Strategy

5. Practice elements of the work ethic such as punctuality, professionalism, dependability, cooperation, and contribution. Personal Development Outcome


*Strategies and outcomes listed after instructional processes reference Pellissippi State’s goals for strengthening general education knowledge and skills, connecting coursework to experiences beyond the classroom, and encouraging students to take active and responsible roles in the educational process.

IV. Expectations for Student Performance*:

Upon successful completion of this course, the student should be able to:

1. Demonstrate an ability to understand basic terminology and general concepts associated parallel systems. A, D, F, G

2. Evaluate and analyze parallel models of computation. A, G

3. Find resources and information to perform specific tasks. B, C

4. Understand different parallel programming paradigms. A, D, F

5. Use fundamental parallel applications, utilities, and tools. D, F, H

6. Develop an understanding of different alternative solutions to a given problem and cost/benefit analysis associated with each. A, D, F

7. Use Internet and communication tools effectively. C, E

8. Produce documentation, sources of information, and reports in a timely, well-organized manner. C, E, H

9. Demonstrate skills to understand hardware and software issues in high performance computing field in general and suggest innovative solutions. A, D, F, G, H

*Letters after performance expectations reference the course objectives listed above.

V. Evaluation:

A. Testing Procedures: 50% of grade

There will be three exams including final exam. Three exams will count for 40% of the final grade. Quizzes will be given for every chapter covered including handouts. Quizzes will count for 10% of the final grade.

B. Laboratory Expectations: 50% of grade

Four projects will be assigned during the course of the semester. Failure to satisfactorily complete any assigned project will result in a grade of F for the course. Projects will count 50%
of the final grade.

C. Field Work:

N/A

D. Other Evaluation Methods:

N/A

E. Grading Scale:

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<tr>
<th>Score Range</th>
<th>Grade</th>
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<tbody>
<tr>
<td>90 - 100</td>
<td>A</td>
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<tr>
<td>80 - 89</td>
<td>B</td>
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<tr>
<td>70 - 79</td>
<td>C</td>
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<tr>
<td>60 - 69</td>
<td>D</td>
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<tr>
<td>0 - 59</td>
<td>F</td>
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VI. Policies:

A. Attendance Policy:

Attendance is required in both the lecture and lab session. Pellissippi State Technical Community College expects students to attend all scheduled instructional activities. As a minimum, students in all courses must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course.

B. Academic Dishonesty:

Plagiarism, cheating, software piracy, non-educational use of computer systems and other forms of academic dishonesty are strictly prohibited. A student guilty of academic misconduct, either directly or indirectly through participation or assistance, is immediately responsible to the instructor of the class. In addition to other possible disciplinary sanctions that may be imposed through the regular Pellissippi State procedures as a result of academic misconduct, the instructor has the authority to assign an F or a zero for the exercise or examination or to assign an F in the course.

C. Other Policies:

Each student is expected to do his/her own work in this class. If a student is unable to complete an assignment on his/her own, it is the student's responsibility to get help from the instructor (before the assignment is due).

In the event that a student has an emergency beyond his/her control, the student must notify the instructor in advance, if at all possible.