Application for New Course

1. Submitted by the College of Engineering
   Department/Division offering the course: Computer Science
   Date: August 1, 2000

2. Proposed designation and Bulletin description of this course:
   (a) Prefix & Number: CS 621
   (b) Full Title: Parallel and Distributed Computing
       Abbreviated Title (≤ 24 characters): Parallel and Distr Comput
   (c) Lecture/Discussion hours per week: 3
   (d) Laboratory hours per week: 0
   (e) Studio hours per week: 0
   (f) Credits: 3
   (g) Course description:
       This course provides graduate students in computer science and in other fields of science and engineering with experience of parallel and distributed computing. It gives an overview of parallel and distributed computers, and parallel computation. The course addresses architectures, languages, environments, communications, and parallel programming. Emphasis on understanding parallel and distributed computers and portable parallel programming with MPI.
   (h) Prerequisites (if any): Two 500 level CS courses, or consent of the instructor.
   (i) May be repeated to a maximum of: Not applicable

4. To be cross listed as: not applicable
   Signature of cross-listing chair: ____________________________

5. Effective date: Fall 2001

6. Course to be offered:
   Fall Spring Summer
   X

7. Will the course be offered annually; explain if not: Yes

8. Why is the course needed? This course is needed for students to learn modern high performance (parallel and distributed memory) computers and the application techniques that can be efficiently implemented on the parallel and distributed memory computers to solve important large-scale problems.

9. (a) By whom will the course be taught? Jun Zhang
    (b) Are facilities for teaching this course now available? Yes
        If not, what plans have been made for providing them?

10. What enrollment may reasonably be expected? 15

   FEB 14 2001
11. Will this course serve students in the Department primarily? Yes
Will it be of service to a significant number of students outside the Department? No
If yes, under what area?

12. Check the category most applicable to this course:
   ___ traditional; offered in corresponding departments elsewhere;
   X relatively new, now being widely established;
   ___ not yet found in many (or any) other universities

13. Is this course part of a new proposed program? No
If yes, which?

14. Will adding this course change the degree requirements in any programs? No
If yes, explain:

15. Attach a list of the major teaching objectives of the proposed course and outline
and/or a reference list to be used: See attached

16. If the course is a 100-200 level course, please submit evidence (e.g., correspondence)
that the Community College System has been consulted.
   not applicable

17. Within the Department, who should be contacted for further information about the
proposed course?
   Name: Jun Zhang or Craig Douglas    Phone: 257-3892/257-2326

---

1Approval of this course will constitute approval of the program change unless other program modifications are proposed.
Signatures of Approval:

Department Chair: ___________________ Date: 11/14/2022

Dean of the College: ___________________ Date: 2/8/01

Date of Notice to the Faculty: 1/26/01

Undergraduate Council: ___________________ Date: ________

University Studies: ___________________ Date: ________

Graduate Council: ___________________ Date: 8/27/01

Senate Council: ___________________ Date: ________

Date of Notice to the University Senate: ________

Action other than approval: ____________________

---

2If applicable, as provided by the Rules of the University Senate
**Needed Skills**
No previous experience with parallel computers is necessary. Programming skill in a high level programming language such as C or Fortran is required.

**Learning Outcomes**
Students will learn about parallel and distributed computers. They will be able to write portable programs for parallel or distributed architectures using Message-Passing Interface (MPI) library.

**Course Outline**
(This is a sample outline. Exact outline will be determined by the instructor offering this course):

- Parallel architectures and communications
  - limitations of sequential computers
  - SISD, SIMD, MIMD and networked computers
  - shared memory and distributed memory computers
  - static and dynamic interconnections
  - message routing schemes
- Performance and scalability
  - speedup, granularity, cost-optimality
  - isoefficiency functions
  - Amdahl's law and its suitability
- Fast Fourier Transform (FFT)
  - serial algorithm
  - binary-exchange algorithm
  - transpose algorithm
  - cost-effectiveness of meshes and hypercubes for FFT
- Dense matrix computations
  - striped and checkboard partitionings
  - matrix transposition
  - matrix-vector and matrix-matrix multiplications
  - Canon's and Fox's algorithms
  - Gaussian elimination
- Message Passing Interface
  - basic MPI functions
  - blocking and nonblocking communications
  - local and global communication functions
  - groups and communicators
  - applications and case studies
- Advanced Message Passing in MPI
  - MPI datatypes
  - matrix algorithms
  - linear systems
Grading
Exact details about graded work in this course will be determined by the instructor offering the course and will be made available in the syllabus during the first class meeting. Typically, a student's grade will be determined by a weighted average of homework assignments, programming projects, midterm and final examinations. A typical weighting is:

- Homework: 20%
- Programming projects: 30%
- Midterm Examination: 20%
- Final Examination: 30%


Possible Textbooks
Introduction to Parallel Computing (tentative)
  by Vipin Kumar, Ananth Grama, Anshul Gupta, and George Karypis
Using MPI: Portable Parallel Programming with the Message-Passing Interface (optional)
  by William Gropp, Ewing Lusk, and Anthony Skjellum