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| For Academic Affairs and Research Use Only | |
| CIP Code: |  |
| Degree Code: |  |

**New Course Proposal Form**

**[ ] Undergraduate Curriculum Council**

**[X] Graduate Council**

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| **[X] New Course or [ ]Experimental Course (1-time offering) (Check one box)** |

Signed paper copies of proposals submitted for consideration are no longer required. Please type approver name and enter date of approval.

Email completed proposals to [curriculum@astate.edu](mailto:curriculum@astate.edu) for inclusion in curriculum committee agenda.

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| Edward Hammerand 9/24/2017 **Department Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **COPE Chair (if applicable)** |
| Hung-Chi Su 9/24/2017 **Department Chair:** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Head of Unit (If applicable)** |
| David F. Gilmore 10/6/2017 **College Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Undergraduate Curriculum Council Chair** |
| Anne A. Grippo 10/6/2017 **College Dean** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Graduate Curriculum Committee Chair** |
| |  |  | | --- | --- | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Enter date |   **General Education Committee Chair (If applicable)** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Vice Chancellor for Academic Affairs** |

1. Contact Person (Name, Email Address, Phone Number)

Dr. Hai Jiang, hjiang@astate.edu, (870)680-8164

2. Proposed Starting Term and Bulletin Year

Spring, 2018

3. Proposed Course Prefix and Number (Confirm that number chosen has not been used before. For variable credit courses, indicate variable range. *Proposed number for experimental course is 9*. )

CS 6223

4. Course Title – if title is more than 30 characters (including spaces), provide short title to be used on transcripts. Title cannot have any symbols (e.g. slash, colon, semi-colon, apostrophe, dash, and parenthesis). Please indicate if this course will have variable titles (e.g. independent study, thesis, special topics).

Advanced Computer Architecture

5. Brief course description (40 words or fewer) as it should appear in the bulletin.

Advanced topics on computer architecture, including: memory hierarchy design; instruction-level parallelism in pipelines; data-level parallelism in vector, SIMD and GPU architectures; thread-level parallelism; warehouse-scale computers.

6. Prerequisites and major restrictions. (Indicate all prerequisites. If this course is restricted to a specific major, which major. If a student does not have the prerequisites or does not have the appropriate major, the student will not be allowed to register).

1. **Yes** Are there any prerequisites?
   1. If yes, which ones?

CS 3113 or “B” or better in CS 5032 and CS 3223

* 1. Why or why not?

The material covered by the course requires understanding of advanced programming concepts (CS3113 or CS5032) and some background knowledge of computer architecture (CS3223).

1. **No** Is this course restricted to a specific major?
   1. If yes, which major? Enter text...

7. Course frequency(e.g. Fall, Spring, Summer). *Not applicable to Graduate courses.*

8. Will this course be lecture only, lab only, lecture and lab, activity, dissertation, experiential learning, independent study, internship, performance, practicum, recitation, seminar, special problems, special topics, studio, student exchange, occupational learning credit, or course for fee purpose only (e.g. an exam)? Please choose one.

Lecture only

9. What is the grade type (i.e. standard letter, credit/no credit, pass/fail, no grade, developmental, or other [please elaborate])

Standard letter

10. **No** Is this course dual listed (undergraduate/graduate)?

11. **No** Is this course cross listed?

*(If it is, all course entries must be identical including course descriptions. Submit appropriate documentation for requested changes. It is important to check the course description of an existing course when adding a new cross listed course.)*

**11.1** – If yes, please list the prefix and course number of cross listed course.

Enter text...

**11.2** – **Yes / No** Are these courses offered for equivalent credit?

Please explain. Enter text...

12. **Yes** Is this course in support of a new program?

a. If yes, what program?

High Performance Computing Certificate

13. **No** Does this course replace a course being deleted?

a. If yes, what course?

Enter text...

14. **No** Will this course be equivalent to a deleted course?

a. If yes, which course?

Enter text...

15. **Yes** Has it been confirmed that this course number is available for use?

*If no: Contact Registrar’s Office for assistance.*

16. **No** Does this course affect another program?

If yes, provide confirmation of acceptance/approval of changes from the Dean, Department Head, and/or Program Director whose area this affects.

Enter text...

**Course Details**

17. Outline (The course outline should be topical by weeks and should be sufficient in detail to allow for judgment of the content of the course.)

Week 1: Overview

Week 2: Cache

Week 3: Memory Hierarchy Design

Week 4: Digital Circuits

Week 5: Instruction Set Principles

Week 6: Pipelined Datapath

Week 7: Pipeline Hazards

Week 8: Branch Prediction

Week 9: Dynamic Scheduling

Week 10: Instruction-Level Parallelism in Pipelines

Week 11: Vector, SIMD and GPU Architecture

Week 12: Data-Level Parallelism in Vector, SIMD and GPU Architecture

Week 13: Thread-Level Parallelism

Week 14: Warehouse-Scale Computers

18. Special features (e.g. labs, exhibits, site visitations, etc.)

N/A

19. Department staffing and classroom/lab resources

1. Will this require additional faculty, supplies, etc.?

No. The course has already been part of the rotation as a special topics subject. Its addition to the bulletin as a regular course will have no impact on department staffing or resources.

20. **No** Does this course require course fees?

*If yes: please attach the New Program Tuition and Fees form, which is available from the UCC website.*

**Course Justification**

21. Justification for course being included in program. Must include:

a. Academic rationale and goals for the course (skills or level of knowledge students can be expected to attain)

High performance computing is critical in the current computer world. However, computer performance relies on hardware structure heavily. Therefore, this proposed course helps graduate students acquire sufficient knowledge to pursue careers in the high performance computing field.

b. How does the course fit with the mission established by the department for the curriculum? If course is mandated by an accrediting or certifying agency, include the directive.

The department curriculum has included computer organization for undergraduate students since the inception of the undergraduate degrees. This new course will help equip graduate students with more detailed knowledge. It will strengthen the current department curriculum in the direction of major research schools.

c. Student population served.

Graduate.

d. Rationale for the level of the course (lower, upper, or graduate).

Students should have sufficient study skills and maturity to master the sophisticated hardware structure concepts. Graduate students are best prepared to accomplish it.

**Assessment**

**University Outcomes**

22. Please indicate the university-level student learning outcomes for which this new course will contribute. Check all that apply.

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| * 1. **[ ]** Global Awareness | * 1. **[X ]** Thinking Critically | * 1. **[X ]** Information Literacy |

**Relationship with Current Program-Level Assessment Process**

23. What is/are the intended program-level learning outcome/s for students enrolled in this course? Where will this course fit into an already existing program assessment process?

1. M.S. Computer Science graduate students should have a deeper understanding of the theory and application of algorithms, programming languages, and computer processes.
2. M.S. Computer Science graduate students should have the ability to apply advanced analysis techniques to problem identification and solution in computing applications.
3. M.S. Computer Science graduate students should have the ability to apply advanced implementation techniques to problem identification and solution in computing applications.

The course will be assessed along with other graduate courses on the same schedule.

24. Considering the indicated program-level learning outcome/s (from question #23), please fill out the following table to show how and where this course fits into the program’s continuous improvement assessment process.

*For further assistance, please see the ‘Expanded Instructions’ document available on the UCC - Forms website for guidance, or contact the Office of Assessment at 870-972-2989.*

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| **Program-Level Outcome 1 (from question #23)** | M.S. Computer Science graduate students should have a deeper understanding of the theory and application of algorithms, programming languages, and computer processes. |
| Assessment Measure | Comprehensive examinations and employer surveys |
| Assessment  Timetable | Comprehensive exams will be conducted each semester, reviewed annually, and reported on every three years; employer surveys will be conducted each fall and reported on every four years. |
| Who is responsible for assessing and reporting on the results? | Department assessment committee. |

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| **Program-Level Outcome 2 (from question #23)** | M.S. Computer Science graduate students should have the ability to apply advanced analysis techniques to problem identification and solution in computing applications. |
| Assessment Measure | Comprehensive examinations and employer surveys |
| Assessment  Timetable | Comprehensive exams will be conducted each semester, reviewed annually, and reported on every three years; employer surveys will be conducted each fall and reported on every four years. |
| Who is responsible for assessing and reporting on the results? | Department assessment committee. |

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| **Program-Level Outcome 3 (from question #23)** | M.S. Computer Science graduate students should have the ability to apply advanced implementation techniques to problem identification and solution in computing applications. |
| Assessment Measure | Comprehensive examinations and employer surveys |
| Assessment  Timetable | Comprehensive exams will be conducted each semester, reviewed annually, and reported on every three years; employer surveys will be conducted each fall and reported on every four years. |
| Who is responsible for assessing and reporting on the results? | Department assessment committee. |

*(Repeat if this new course will support additional program-level outcomes)*

**Course-Level Outcomes**

25. What are the course-level outcomes for students enrolled in this course and the associated assessment measures?

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| **Outcome 1** | Students will become familiar with the theory and practice associated with advanced computer architecture. |
| Which learning activities are responsible for this outcome? | In-class discussion and illustrations  Demonstration of analysis results in presentations |
| Assessment Measure | Course presentations, exams and projects |

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| **Outcome 2** | Students will master the corresponding hardware analysis skills. |
| Which learning activities are responsible for this outcome? | Accomplish related literature reviews  Perform analytic evaluation of example algorithms |
| Assessment Measure | Course presentations and exams |

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| **Outcome 3** | Students will get experience with computer hardware structure which will develop implementation and programming skills which take effective advantage of hardware components. |
| Which learning activities are responsible for this outcome? | In-class discussion and illustrations  Accomplish related literature reviews  Conduct effective projects |
| Assessment Measure | Course homework and projects |

*(Repeat if needed for additional outcomes)*

**Bulletin Changes**

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| **Instructions** |
| **Please visit** [**http://www.astate.edu/a/registrar/students/bulletins/index.dot**](http://www.astate.edu/a/registrar/students/bulletins/index.dot) **and select the most recent version of the bulletin. Copy and paste all bulletin pages this proposal affects below. Follow the following guidelines for indicating necessary changes.**  **\*Please note: Courses are often listed in multiple sections of the bulletin. To ensure that all affected sections have been located, please search the bulletin (ctrl+F) for the appropriate courses before submission of this form.**  - Deleted courses/credit hours should be marked with a red strike-through (~~red strikethrough~~)  - New credit hours and text changes should be listed in blue using enlarged font (blue using enlarged font).  - Any new courses should be listed in blue bold italics using enlarged font (***blue bold italics using enlarged font***)  *You can easily apply any of these changes by selecting the example text in the instructions above, double-clicking the ‘format painter’ icon 🡪 , and selecting the text you would like to apply the change to.*  *Please visit* [*https://youtu.be/yjdL2n4lZm4*](https://youtu.be/yjdL2n4lZm4) *for more detailed instructions.* |

**2017-2018 Graduate Bulletin**

**Page 375**

**CS 5823. Scripting Languages** Examination of scripting languages compared to conventional programming languages and construction of domain-specific solutions for common problems in GUI, networking, and web programming. Prerequisite: CS 3113 or “B” or better in CS 5032.

**CS 583V. Internship** Supervised work experience participating in application system development in a business/manufacturing environment. Grade earned will be pass or fail. Prerequisites: Permission of the Computer Science faculty, CS 3113 or “B” or better in CS 5032, and either CS 3123 or CS 5113.

**CS 6213. Parallel Processing** Parallel processing and supercomputer architecture with emphasis on efficient utilization of resources. Prerequisite: CS 3223, or “B” or better in CS 5032 and permission of professor.

***CS 6223. Advanced Computer Architecture Advanced topics on computer architecture, including: memory hierarchy design; instruction-level parallelism in pipelines; data-level parallelism in vector, SIMD, and GPU architectures; thread-level parallelism; warehouse-scale computers. Prerequisite: CS 3113 or “B” or better in CS 5032, and CS 3223.***

**CS 6313. Data Security** Methods for protection, security, and privacy of data; access controls, authentication, cryptographic controls, information flow controls, security kernels. Security of data in networks. Prerequisite: CS 3233 or “B” or better in CS 5032.

**CS 6413. Solid Modeling** Examination of advanced modeling techniques with emphasis on radiosity. Techniques for rapid interactive display of a complex three-dimensional environment will be developed. Prerequisite: CS 3113 or “B” or better in CS 5032 or CS 5423.

**CS 6423. Robotic Software Control** Study of robot manipulators from mathematical and programmed control perspectives. Topics include kinematic representation, manipulator positioning, velocity control, and trajectory calculation. Prerequisite: CS 3113 or “B” or better in CS 5032.