

REQUEST TO COLLEGE CURRICULUM COMMITTEE FOR CURRICULAR IMPROVEMENTS

DEPARTMENT: Computer Science

PROPOSED EFFECTIVE SEMESTER: Fall 2017 COLLEGE: CEAS

PROPOSED IMPROVEMENTS

Academic Program

- ☐ New degree*
☐ New major*
☐ New curriculum*
☐ New concentration*
☐ New certificate
☐ New minor
☒ Revised major
☐ Revised minor
☐ Admission requirements
☒ Graduation requirements
☐ Deletion ☐ Transfer
☒ Other (explain**)

Substantive Course Changes

- ☐ New course
☐ Pre or Co-requisites
☐ Deletion (required by others)
☐ Course #, different level
☐ Credit hours
☐ Enrollment restriction
☐ Course-level restriction
☐ Prefix ☐ Title and description
 (attach current & proposed)
☐ General education (select one)
 Not Applicable
☐ Other (explain**)

Misc. Course Changes

- ☐ Title
☐ Description (attach current & proposed)
☐ Deletion (not required by others)
☐ Course #, same level
☐ Variable credit
☐ Credit/no credit
☐ Cross-listing
☐ COGE reapproval
☐ Other (explain**)

** Other: clean up catalog

Title of degree, curriculum, major, minor, concentration, or certificate: Graduate Degree Program – Doctor of Philosophy in Computer Science

Existing course prefix and #:

Proposed course prefix and #:

Credit hours:

Existing course title:

Proposed course title:

Existing course prerequisite & co-requisite(s):

Proposed course prerequisite(s)

If there are multiple prerequisites, connect with "and" or "or". To remove prerequisites, enter "none."

Proposed course co-requisite(s)

If there are multiple corequisites, they are always joined by "and."

Proposed course prerequisite(s) that can also be taken concurrently:

Is there a minimum grade for the prerequisites or corequisites?

The default grades are D for undergraduates and C for graduates.

Major/minor or classification restrictions:

List the Banner 4 character codes and whether they should be included or excluded.

For 5000 level prerequisites & corequisites: Do these apply to: (circle one) undergraduates graduates both

Specifications for University Schedule of Classes:

a. Course title (maximum of 30 spaces):

b. Multi-topic course: ☐ No ☐ Yesc. Repeatable for credit: ☐ No ☐ Yesd. Mandatory credit/no credit: ☐ No ☐ Yes

e. Type of class and contact hours per week (check type and indicate hours as appropriate)

1. ☐ Lecture3. ☐ Lecture/lab/discussion5. ☐ Independent study2. ☐ Lab or discussion4. ☐ Seminar or ☐ studio6. ☐ Supervision or practicum

CIP Code (Registrar's use only):

Chair/Director



Date

2/28/17

Chair, College Curriculum Committee

Date

Dean

Date:

Graduate Dean:

Date

Curriculum Manager: Return to dean ☐ Date

Forward to:

Date

Chair, COGE/ PEB / FS President

Date

FOR PROPOSALS REQUIRING GSC/USC REVIEW:

* ☐ Approve ☐ Disapprove

Chair, GSC/USC

Date

* ☐ Approve ☐ Disapprove

Provost

Date

1. Explain briefly and clearly the proposed improvement.

Edit1: Delete the list of courses specified in the "Required credit hours" subsection.

- Edit2: Change the makeup of course requirements to:

The minimum requirement of the completion of 30 credit hours of course work past the master's degree is satisfied by (i) 18 credit hours of regular course work not including independent study, research, seminars and professional field experience; (ii) 3 credit hours of CS7100, Independent Research, to be successfully completed by the third semester of enrollment, followed by 3 credit hours of CS7350, Graduate Research, to be taken during the first two years of enrollment culminating in an approved research report submitted to the department; and (iii) 6 credit hours of course work that may include regular courses, independent study, research, seminars and professional field experience.

Edit3: Add CS6560 (advanced Computer Networks) as an alternative to Systems category of qualifier courses.

2. Rationale. Give your reason(s) for the proposed improvement. (If your proposal includes prerequisites, justify those, too.)

Edit1: Not sure why and at what point in time, this specific list of courses was included in the catalog. Any graduate course offered by the department can satisfy the course-credit-hour requirement. This has been our practice and it was never our intention to restrict the courses taken by a PhD student just to the specified list of courses. Computer science discipline moves very fast and hence we keep offering new courses (both at the graduate as well as undergraduate level) and those are equally important and of interest to the students.

Edit2: CS faculty strongly feels that doctoral students should start on their research as early as possible after enrollment. This requirement will enforce this intent. This will also provide flexibility to students in selecting their courses to get started early in their research and pursue depth in their area of interest.

Edit3: With the growing importance of computer networks, it is the opinion of faculty that advanced general knowledge of computer networks is essential to our PhD students. This proposal asks to add CS6560 as a course in systems qualifier

3. Effect on other colleges, departments or programs. If consultation with others is required, attach evidence of consultation and support. If objections have been raised, document the resolution. Demonstrate that the program you propose is not a duplication of an existing one.

none

4. Effect on your department's programs. Show how the proposed change fits with other departmental offerings.

The Department will be able to regularly offer all courses required for qualifiers. The proposed change in Edit2 will also provide flexibility in course offerings so it fits well with other department offerings.

5. Effects on enrolled students: Are program conflicts avoided? Will your proposal make it easier or harder for students to meet graduation requirements? Can students complete the program in a reasonable time? Show that you have considered scheduling needs and demands on students' time. If a required course will be offered during summer only, provide a rationale.

Since CS6560 is offered frequently, adding CS6560 as a systems qualifier gives PhD students more choices for passing qualifying examination, and further it makes it easy for them to meet graduation requirements.

6. Student or external market demand. What is your anticipated student audience? What evidence of student or market demand or need exists? What is the estimated enrollment? What other factors make your proposal beneficial to students?

The proposed change may increase enrollments in CS6560. By using CS6560 as a systems qualifier, PhD students will benefit by getting a much deeper understanding of computer networks. This should also enhance their job prospects, since the networking skills are in high demand by the external market.

Estimated enrollment in CS6560: 20 students.

Enrollments in CS7100 will increase but this shift in load will be from regular CS courses. In fact, fewer 5000 and 6000-level CS courses may need to be offered on a regular basis allowing faculty to devote more time to CS7100 enrolled students.

7. Effects on resources. Explain how your proposal would affect department and University resources, including faculty, equipment, space, technology, and library holdings. Tell how you will staff additions to the program. If more advising will be needed, how will you provide for it? How often will course(s) be offered? What will be the initial one-time costs and the ongoing base-funding costs for the proposed program? (Attach additional pages, as necessary.)

None. CS7100 and CS7350 are offered regularly.

8. General education criteria. For a general education course, indicate how this course will meet the criteria for the area or proficiency. (See the General Education Policy for descriptions of each area and proficiency and the criteria. Attach additional pages as necessary. Attach a syllabus if (a) proposing a new course, (b) requesting certification for baccalaureate-level writing, or (c) requesting reapproval of an existing course.)

N/A

9. List the learning outcomes for the proposed course or the revised or proposed major, minor, or concentration. These are the outcomes that the department will use for future assessments of the course or program.

Learning outcomes are not changed.

10. Describe how this curriculum change is a response to assessment outcomes that are part of a departmental or college assessment plan or informal assessment activities.

This is a result of informal assessment and improvement based on current faculty consensus and student demands.

11. (Undergraduate proposals only) Describe, in detail, how this curriculum change affects transfer articulation for Michigan community colleges. For course changes, include detail on necessary changes to transfer articulation from Michigan community college courses. For new majors or minors, describe transfer guidelines to be developed with Michigan community colleges. For revisions to majors or minors, describe necessary revisions to Michigan community college guidelines. Department chairs should seek assistance from college advising directors or from the admissions office in completing this section.

N/A

Current Catalog Description (proposed non-editorial changes are highlighted)

Doctor of Philosophy in Computer Science

The doctoral program is designed to develop computer scientists with research expertise in computer science. Specific areas of emphasis include algorithmic complexity theory; bioinformatics, artificial intelligence; cloud computing; compiler optimization; computational (biology, chemistry, finance, mathematics/statistics, medicine, physics); computer architecture; computer graphics; computer networking; computer security; data analytics, data warehousing and mining; distributed and mobile data bases; embedded systems; formal specification and verification; human-computer interaction and visualization; high-performance computing; knowledge-based systems; language and automata theory; mathematical and computer modeling; multimedia databases and systems; neural networks; parallel and distributed algorithms; pattern recognition and image processing; scientific computing and numerical analysis; simulation; software engineering and web applications. The program also permits a student to acquire expertise in closely related fields such as computer engineering and mathematics.

Students completing the program are typically well qualified for teaching and research positions with colleges and universities as well as with national and international industries and laboratories.

The doctoral program is designed to allow a full-time student entering with a Master of Science in Computer Science to complete all degree requirements within three years. However, it is not uncommon for doctoral programs to take longer.

Admission Requirements

A successful applicant to the doctoral program in computer science must satisfy:

1. All of the general admission criteria identified in the Graduate Catalog.
2. Submission of transcripts of prior education.
 - (a) Applicant should have earned or expect to earn a master's degree in computer science. An applicant with a master's degree in electrical or computer engineering, mathematics or a related field will also be considered.
 - (b) An outstanding student who has not completed a master's degree but who has met all other entrance requirements may be considered for admission to the Ph.D. program.
3. Submission of the results of the verbal, analytical, and quantitative portions of the Graduate Record Examination (GRE).
4. Submission of three letters of reference from persons able to assess the student's qualifications for doctoral-level study and likelihood of success; the student and referees would use the forms and procedures available from the department.
5. Submission of a resume that includes a description of academic background and professional experience.
6. Submission of an essay describing the applicant's academic and professional objectives.
7. For international students, the submission of the TOEFL or equivalent examination result.

Financial Assistance

Students accepted into the doctoral program may apply for one of the department's graduate teaching and research assistantships. In addition, advanced Ph.D. students may apply for one of a limited number of doctoral associateships. Graduate internship opportunities with local industries are also available. Applications for teaching and research assistantships should be sent directly to the Department of Computer Science. The forms and instructions for applying for financial assistance can be obtained from the department. Information about non-departmental assistantships and fellowships, tuition remission, special assistance for minority graduate students, general research funds, and tuition grants is available from the Graduate College. Information about student loans and other federal, state, and University need-based financial aid programs is available from the Office of Student Financial Aid and Scholarships.

Program Requirements

The plan of study allows for a considerable variety of emphasis, and students can take advantage of the strengths of the department in matching their interest for their professional development.

A successful candidate for the Ph.D. in Computer Science is responsible for all the general requirements for a doctoral degree as stated in the Graduate Catalog. The remainder of this section restates some of the general requirements and includes additional requirements specific to the doctoral program in computer science.

1. Pre-requisites

A student having prerequisite requirements as a condition of admission must complete all prerequisites before being considered to have entered the doctoral program.

2. Required credit hours

The Ph.D. in computer science requires beyond the student's master's degree the completion of at least 30 credit hours of course work and 12-24 hours of dissertation credits. This implies a total of at least 72 credit hours of graduate work.

The requirement of the completion of at least 30 credit hours of course work past the master's degree is satisfied by (i) at least 24 credit hours of regular course work not including independent study, research, seminars and professional field experience; (ii) 3 credit hours of CS7350, Graduate Research, taken during the first two years of enrollment culminating in a research report submitted to the department; and (iii) 3 credit hours of course work that may include independent study, research, seminars and professional field experience.

CS 5250 - Computer Architecture Credits: 3 hours

CS 5260 - Parallel Computations Credits: 3 hours

CS 5810 - Compiler Design and Implementation Credits: 3 hours

CS 6250 - Advanced Computer Architecture Credits: 3 hours

CS 6260 - Advanced Parallel Computations Credits: 3 hours

CS 6310 - Advanced Design and Analysis of Algorithms Credits: 3 hours

CS 6320 - Intractable Problems and Approximation Algorithms Credits: 3 hours

CS 6550 - Advanced Operating Systems Credits: 3 hours

CS 6800 - Advanced Theory of Computation Credits: 3 hours

CS 6810 - Compiler Optimization Credits: 3 hours

CS 7350 - Graduate Research Credits: 2 to 10 hours

During the first year in the program, the student will be required to complete two to three credit hours on this course accompanied by the production of a technical report.

Computer Seminar Courses

Each doctoral student will be required to complete two computer science seminar courses for one to three credit hours each, with at least one during the first year in the program.

4. Demonstrate competency in two research skills.

Each Ph.D. candidate must obtain departmental approval and demonstrate mastery of two of the following three research skills:

- a. A foreign language other than English, with competency equivalent to a 4000-level course at WMU;
- b. Statistics or probability at the level of MATH 3620 or MATH 3640.
- c. Computer document preparation and library tools.

5. General Qualifying Examination

Before admission to candidacy for the doctoral degree, the student must pass a general qualifying examination in computer science. Students admitted with a master's degree must take one qualifying examination no later than the first time offered after completion of 15 credit hours and must take a second examination no later than the first time offered after completion of 30 credit hours. All students must take all their qualifying examinations no later than the first time offered after completion of 45 credit hours. A student has one opportunity to repeat the qualifying examination. There are five examination topic areas in two categories as follows:

- a. Systems: Computer architecture (CS 6250); Compiler design (CS 6810); Operating systems (CS 6550)
- b. Theory: Design and analysis of algorithms (CS 6310 or CS 6320); Theory of computation (CS 6800)

The student must select three of the five areas for his or her qualifying examination, with at least one exam from each category. The student will have the opportunity to repeat a portion of the qualifying examination once, but may not change the selected areas. The department will determine what area(s) of the examination, if any, the student must repeat.

The qualifying examination may be satisfied by taking the 6000-level courses of the three selected areas (i.e., three of CS 6250, 6310 or 6320, 6550, 6800, 6810). To satisfy the qualifying examination requirements, three of these courses must be passed with at least a "BA" grade.

6. Preliminary Examination

Each doctoral candidate must obtain approval from his or her dissertation committee for a dissertation topic and research plan. This approval process is called the preliminary examination and is structured by each dissertation committee to fit each candidate's program. The preliminary examination must be completed within one year after passing the qualifying examination and at least one year in advance of the dissertation defense. A candidate has one opportunity to repeat the preliminary examination.

7. Complete and successfully defend a dissertation (12 - 24 hrs)

A doctoral dissertation, which is the culmination of an original and substantive research effort by the candidate, must be completed and publicly defended. This study is done under the supervision of a dissertation director and dissertation committee. A dissertation director is appointed by the department, typically within the candidate's first two years in the doctoral program and based on the candidate's interests.

The doctoral dissertation committee is appointed by the Graduate College based on the petition of the candidate and the approval and recommendation of the department chair. The doctoral dissertation committee is comprised of the dissertation director and at least two other members of the graduate faculty, at least one of whom shall be from outside the department.

Committee members facilitate and guide the candidate's academic and research development.

Before a candidate is awarded the Ph.D. degree, each member of the doctoral dissertation committee must approve the dissertation. The completed dissertation is presented by the candidate at a public seminar and oral defense.

CS 7300 - Doctoral Dissertation Credits: 1 to 15 hours

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The doctoral program is designed to allow a full-time student entering with a Master of Science in Computer Science to complete all degree requirements within three years. However, it is common for students to take longer.

Admission Requirements

A successful applicant to the doctoral program in computer science must satisfy all of the general admission criteria identified in the Graduate Catalog and submit the following documents:

1. transcripts of prior education.
 - (a) Applicants should have earned or expect to earn a master's degree in computer science. An applicant with a master's degree in electrical or computer engineering, mathematics or a related field will also be considered.
 - (b) An outstanding student who has completed a bachelor's degree and has met all other entrance requirements may also be considered.
2. results of the Graduate Record Examination (GRE) General Test.
3. three letters of reference from persons able to assess the student's qualifications for doctoral-level study and likelihood of success. The department may also directly contact referees after the submission of the reference letters.
4. a resume that includes a description of academic background and professional experience.
5. an essay describing the applicant's academic and professional objectives.
6. For international students, the TOEFL or equivalent English language examination result.

Financial Assistance

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of CS7100, Independent Research, to be successfully completed by the third semester of enrollment, followed by 3 credit hours of CS7350, Graduate Research, to be taken during the first two years of enrollment culminating in an approved research report submitted to the department; and (iii) 6 credit hours of course work that may include regular courses, independent study, research, seminars and professional field experience.

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There are five examination topic areas in two categories as follows:

- a. Systems: Computer architecture (CS 6250); Operating systems (CS 6550); Advanced Computer Networks (CS6560); Compiler theory and practice (CS 6810)
- b. Theory: Design and analysis of algorithms (CS 6310 or CS 6320); Theory of computation (CS 6800)

The student must select three of the six areas for his or her qualifying examination, with at least one exam from each category. The student will have the opportunity to repeat a portion of the qualifying examination once, but may not change the selected areas. The department will determine what area(s) of the examination, if any, the student must repeat.

The qualifying examination may be satisfied by taking the 6000-level courses of the three selected areas (i.e., three of CS 6250, 6310 or 6320, 6550, 6560, 6800, 6810). To satisfy the qualifying examination requirements, the three selected courses must be passed with at least a "BA" grade.

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6. Complete and successfully defend a dissertation (12 - 24 credit hours of CS7300)

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