



College of Engineering

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Date: 16 August 2010

To: Randy Smith
Vice Provost, Office of Academic Affairs

From: Ed McCaul 
Secretary, College of Engineering Committee on Academy Affairs (CCAA)

Subject: Semester Conversion Proposals for the BS, BS/MS, MS, and PhD
degree programs in Computer Science and Engineering

Attached is a letter from Xiaodong Zhang, Department Chair of Computer Science and Engineering (CSE), as well as semester conversion proposals for their BS, MS, and PhD degrees. A conversion proposal for their BS/MS program is not included as CSE will be following the college's requirements for these programs as stated in Zhang's cover letter.

The proposals were reviewed by a subcommittee of CCAA. After reviewing the proposals and having some changes made to them the subcommittee recommended to the full committee that they be approved. After a discussion, CCAA unanimously approved the proposals on the 11th of August 2010 and requested that I forward the proposals to you for consideration by CAA. If you have any questions concerning these proposals please let me know.

To: Engineering College Committee on Academic Affairs

From: Xiaodong Zhang, CSE Department Chair

Date: 30 July 2010

Re: Semester Proposals for *BS, MS, and PhD in Computer Science and Engineering*

The faculty of Computer Science and Engineering have worked diligently since early Au09 to prepare the attached proposal. The CSE Semester Task Force comprising about fifteen CSE faculty members, academic advising staff, and undergraduate and graduate students, began meeting weekly at the start of Au09 to plan the semester conversion. Data collected during these deliberations included historical feedback from CSE graduates (compiled as part of accreditation-based assessment processes over the past 10+ years), input from the CSE Department Industrial Advisory Committee, a survey of all CSE faculty on various issues related to the transition, the Undergraduate Forum (an annual open meeting with undergraduate students), and comparisons with about a dozen computer science and engineering, computer science, and similarly named programs at major peer institutions.

The faculty have voted to approve the attached proposals as our semester plans for the *BS, MS, and PhD in Computer Science and Engineering*, and I also recommend approval. The vote of all CSE faculty members on the BS CSE proposal was 39 in favor, 0 opposed, 0 abstentions; the vote of all CSE graduate faculty members on the MS CSE and PhD CSE proposals was 34 in favor, 0 opposed, 0 abstentions.

Regarding the combined BS/MS program, CSE participates under the common provisions of the College of Engineering for such programs, as described in the Engineering cover letter, and imposes no additional requirements or provisions.

The CSE Department currently administers the following other academic programs whose semester conversion proposals are not included in this package. None of these academic programs is being withdrawn; all will be converted to semesters.

- Graduate Interdisciplinary Specialization/Minor in Applied Software Engineering (a graduate program in Engineering; we will submit a revised program proposal to the Engineering College Committee on Academic Affairs by the end of August 2010)
- Minor in Computational Science and Engineering (an undergraduate minor program in Engineering; this program, which needs to undergo a pre-approval through the state's Ralph Regula School of Computational Science, will be submitted to the Engineering College Committee on Academic Affairs as soon as practical)
- BS in Computer and Information Science (a program in Arts and Sciences; we will submit a revised program on the schedule of other ASC major programs)
- BA in Computer and Information Science (a program in Arts and Sciences; we will submit a revised program on the schedule of other ASC major programs)
- Minor in Computer and Information Science (a program in Arts and Sciences; we will submit a revised program on the schedule of other ASC minor programs)

Brunnweide, Assoc. Chair (for X. Zhang)

Xiaodong Zhang

Robert M. Critchfield Professor, and CSE Department Chair

BS in Computer Science and Engineering (BS CSE) Program

Primary Contact: Bruce W. Weide (weide.1, 292-1517)

1. Name of Program

Computer Science and Engineering

2. Name of Degree

Bachelor of Science in Computer Science and Engineering (BS CSE)

3. Responsible Academic Unit

Department of Computer Science and Engineering

4. Type of Program

a. Undergraduate bachelors degree program

5. Semester Conversion Designation

a. Re-envisioned with significant changes to curricular requirements (core requirements, tracks/options/courses), but no changes to program goals

6. Program Learning Goals

Because of a requirement to use the terminology of the CSE program's accrediting body (ABET, Inc.), program goals are separated into "objectives" and "outcomes". Roughly speaking, the former describe what program graduates will be doing a couple years after graduation, while the latter describe knowledge and skills they will attain by the time of graduation.

The *objectives* of the BS CSE program are:

- I. Graduates of the program will be employed in the computing profession, and will be engaged in learning, understanding, and applying new ideas and technologies as the field evolves.
- II. Graduates with an interest in, and aptitude for, advanced studies in computing will have completed, or be actively pursuing, graduate studies in computing.
- III. Graduates will be informed and involved members of their communities, and responsible engineering and computing professionals.

The *outcomes* of the BS CSE program are that students will attain:

- a. an ability to apply knowledge of computing, mathematics including discrete mathematics as well as probability and statistics, science, and engineering;
- b. an ability to design and conduct experiments, as well as to analyze and interpret data;
- c. an ability to design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints such as memory, runtime efficiency, as well as appropriate constraints related to economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability considerations;
- d. an ability to function on multi-disciplinary teams;

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- e. an ability to identify, formulate, and solve engineering problems;
- f. an understanding of professional, ethical, legal, security and social issues and responsibilities;
- g. an ability to communicate effectively with a range of audiences;
- h. an ability to analyze the local and global impact of computing on individuals, organizations, and society;
- i. a recognition of the need for, and an ability to engage in life-long learning and continuing professional development;
- j. a knowledge of contemporary issues;
- k. an ability to use the techniques, skills, and modern engineering tools necessary for practice as a CSE professional;
- l. an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution;
- m. an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices;
- n. an ability to apply design and development principles in the construction of software systems of varying complexity.

7. Proposed Program Requirements

See Attachment #1: BS CSE Proposed Program Requirements. The following notes apply to the pick-lists in the requirements:

- The designated General Education course (“Culture and Ideas: Ethics”) will be chosen from a set to be designated by the College of Engineering once other departments’ offerings and General Education approved courses are known.
- “Mathematics Elective” course may be any intermediate or advanced mathematics or statistics course chosen from a set to be designated by the CSE Undergraduate Studies Committee once Mathematics and Statistics course offerings are known.
- “Science Elective” course may be any physical or biological science course chosen from a set to be designated by the CSE Undergraduate Studies Committee once science course offerings are known.
- “Project” course may be any version of CSE 3901, chosen in consultation with an academic advisor, depending on the student’s interests and background.
- “Capstone Design” course may be any version of CSE 4901, chosen in consultation with an academic advisor, depending on the student’s interests and background.
- “Technical Elective” courses will be chosen in consultation with an academic advisor, from CSE upper division undergraduate courses (3000 or above), and from a set of non-CSE courses to be designated by the CSE Undergraduate Studies Committee once other departments’ course offerings are known. At least 8 of the 15 required technical elective cr-hrs must be CSE courses. Up to 7 of the 15 required technical elective cr-hrs may be double-counted from one of a set of “related minors” to be designated by the CSE Undergraduate Studies Committee once other departments’ minor offerings are known.

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8. Current and Proposed Advising Sheets

See Attachments #2 and #3 (current BS CSE program requirement sheets and associated advising sheet) and Attachments #4 and #5 (BS CSE Proposed Advising Sheet and BS CSE Proposed Advising Roadmap). Requirements for admission to the major are essentially converted directly to semesters and are not further discussed.

9. Curriculum Map

See Attachment #6.

10. Rationale for Program Changes and Description of Changes

The major decisions from the CSE Semester Task Force investigation were:

- Most CSE semester courses should be 3 sem-cr-hrs, with some 4-sem-cr-hr courses where there are significant out-of-class assignments (primarily programming “lab” assignments). We decided not to take the approach of directly converting existing 3-qtr-cr-hr courses into equivalent 2-sem-cr-hr semester courses. The reason for this decision was that students should not be expected to take 7-8 separate courses in a single term in order to average the 16 cr-hrs per semester required to graduate in four years.
- Much of the breadth of the existing BS CSE major should be retained, with some concession because students are taking only about 2/3 as many different courses as under quarters. The rationale was that CSE is a broad, fast-changing discipline, and premature specialization by undergraduate students could be detrimental to their career development as it could limit their adaptability in the face of future shifts in the field. We felt that achieving a better understanding of fundamental principles that have withstood the test of time, across a rather wide swath through the field, would best serve CSE students.
- Students should have considerable flexibility in making their own trade-offs between depth and additional breadth when choosing technical electives. The reason for this conclusion (in light of the previous comments) was that some students might know that they would like to specialize in an area of the field that is reasonably stable and well-developed, and that it would be folly not to permit this.

The primary substantive changes in the proposed program are as follows:

- General Education courses constitute 24 sem-cr-hrs of the proposed program, compared to 40 qtr-cr-hrs now. CSE currently requires one more 5-qtr-cr-hr GEC course than the other Engineering programs, designating this to be Communications 321 (a public speaking course), and designating one social science course to be economics—both decisions based on feedback from graduates and employers. The proposed General Education model for semesters was issued by ULAC during our deliberations. We agreed that CSE should no longer have a more stringent General Education requirement than the rest of Engineering after the conversion. So, the remaining 35 qtr-cr-hrs in this part of the current CSE program are reduced to $(2/3)*35 \approx 24$ sem-cr-hrs. For CSE, this means there are still 8 courses in General Education. Any change to program quality from this part of the proposed new CSE program will arise from improvements in the General Education courses themselves, as there is no significant change in the CSE program requirements in this dimension.
- The Engineering Core is significantly streamlined from what it is under quarter, as explained in the Engineering cover letter. Any change to program quality from this part

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of the proposed new CSE program will arise from improvements in the Engineering Core courses themselves. The primary consequence of a 30%+ reduction in the total number of courses overall, however, is a reduction in the number of other Engineering cr-hrs and in the breadth of exposure to other Engineering disciplines compared to the current situation. This was deemed unavoidable: most Engineering courses now are 3 qtr-cr-hrs, and we agreed at the College of Engineering level as well as in the CSE Department that it would be untenable to turn these into 2-sem-cr-hr courses in order to preserve the breadth of the current Engineering programs. The net effect is that program quality improvements will come from students being better prepared overall in the major, as a relatively larger fraction of each Engineering program (including CSE) comes from courses taken within the program's offering unit.

- The CSE Core in the proposed program mirrors the content areas in the current program, but now involves a choice between two courses in each of four technical areas; currently, some courses in these areas are required while others are optional. In addition, there is added flexibility for students in selecting a mathematics or statistics course. (The current program offers a choice of a science course, as does the proposed program.) Any change to program quality from this part of the proposed new CSE program will arise from the additional depth of content in the required core course content areas, which were determined by the CSE faculty to be those most important to *all* CSE graduates.
- The Technical Electives portion of the proposed program is slightly smaller than it is under quarters. As now, the CSE faculty will prepare a few suggested sets of technical electives to guide students with particular interests, e.g., artificial intelligence, computer graphics, computer systems, networking, security, software engineering, etc. But overall, the technical elective structure will mirror the current "Individualized Option" in CSE technical electives. We will continue to encourage students to minor in a related field by allowing them to count nearly half of the cr-hrs in such a minor as technical electives in their major program. Any change to program quality from this part of the proposed new CSE program will arise from the additional depth of content in technical elective course content areas as such courses change from quarters to semesters.

The last significant CSE major program revision was in late 2007. The main changes were to revise the GEC requirements from 45 qtr-cr-hrs to 35 qtr-cr-hrs plus Communication 321 ("Principles of Effective Public Speaking"). This resulted in the overall program size being reduced from 196 cr-hrs to 191 cr-hrs. At the same time, a number of changes were made in the technical elective options. The most significant one was to introduce recommended "tracks" in the Individualized Option, to be used as guidance to students in selecting technical electives. Each track consists of a number of required and recommended CSE courses, and recommended minor programs; for example, the computer graphics/animation track recommends that students in the track complete the Studio Art minor or the Industrial, Interior and Visual Communication Design minor. The Individualized Option, including these changes, has been very successful and popular with students. Hence, the technical electives portion of the proposed semester program borrows heavily from it.

11. Credit Hour Changes

In Engineering, all cr-hrs other than GEC (or General Education) are counted as part of the "major program"; they are divided into a number of categories within the major program. The ranges of values in required courses offered inside and outside CSE arise from allowing flexible options in technical electives with bounds on the number of inside/outside cr-hrs.

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	Number of qtr-cr-hrs in current program	Calculated result for 2/3 of current qtr-cr-hrs	Number of sem-cr-hrs required for proposed program
Total cr-hrs required for completion of program	191	127.3	126
Prerequisite cr-hrs required for admission to program which are not counted toward total hours	4	2.7	2-3
Required cr-hrs offered by the unit	63-75	42.0-50.0	50-57
Required cr-hrs offered outside of the unit	116-128	77.3-85.3	69-76

12. Rationale for Significant Change in Credit Hours

As explained in Section 10, the proportion of required cr-hrs offered by CSE (row 3 above) will be larger than it is now as a result of a reduction in the Engineering core relative to total program cr-hrs. There was a conscious decision at both the College and Department levels to favor, in the conversion, depth in the major over breadth across Engineering.

13. Transition Policy

No CSE major who began the degree program under quarters will have progress toward graduation impeded by the transition to semesters. Graduation requirements beginning Su 2012 will be those for CSE majors under semesters; but *every* quarter-credit-hour that would have counted toward the CSE major under the quarter-based CSE program will count (as 2/3 of a semester-credit-hour) toward the requirements for graduation under the semester CSE program. Additional advising support will be provided for CSE majors to assist in planning course schedules for the last year of quarters (2011-2012) and for at least the first year of semesters. If it is determined that the “normal” conditions covered by the CSE major transition worksheet would result in any student facing an unavoidable delay in graduation compared to quarters due to the change to semesters—rather than the student’s failure to meet with an advisor to complete the worksheet or to make satisfactory progress through the mutually agreed program plan—then a revision of specific requirements will be worked out for that student by the advising staff with approval by the CSE Undergraduate Studies Committee.

— Xiaodong Zhang, CSE Department Chair

The transition policy is based on the following principles:

- The switch to semesters will impede no student’s progress toward graduation.
- All students who graduate under semesters, even during the first semester, will do so by meeting the requirements of the semester program.
- Each semester program requirement may be met either by taking an appropriate semester course or sequence, or by substituting a substantially equivalent quarter course or sequence for the corresponding semester course or sequence.

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- Excess equivalent credit-hours resulting from such substitutions—either positive or negative—will be credited against technical elective requirements.

Attachment #7: BS CSE Proposed Transition Worksheet is a sample (for a particular student, Alice) of a web-based form that will be used to calculate the effect of observing these principles. The cells with a **dark green background**, along the first column and near the bottom, contain information specific to a student, and are intended to be filled in by the student working with an academic advisor. The remaining cells are fixed, and indicate the substitution mapping between courses that are part of the current CSE major program and those of the semester program.

In the sample shown, Alice has completed six GEC courses plus Engineering 100, Engineering 181, etc. (the rows containing a “1” in column 1); but not the two remaining GEC courses, Math 566, etc. (the rows that are empty in column 1). Near the bottom of the worksheet, the row containing “Anything else counted now” shows 24 additional qtr-cr-hrs that would have counted toward Alice’s CSE major under quarters. The spreadsheet calculates for Alice the three values labeled “Total cr-hrs”, “Excess Gen Ed cr-hrs”, and “Remaining Tech Elective cr-hrs”.

The results: Alice has 134 qtr-cr-hrs toward the CSE major. The conversion results in an excess of 1.98 cr-hrs in the Gen Ed categories covered by substitutions. Alice needs to take two more Gen Ed courses under semesters in the categories not covered. The 1.98 excess cr-hrs in Gen Ed courses already covered reduce Alice’s CSE technical elective requirements by 1.98 cr-hrs.

Accounting for remaining courses similarly but separately from Gen Ed, Alice’s substitutions result in an excess (net of the Gen Ed contribution above) of –10.69 sem-cr-hrs in technical electives, i.e., Alice still has 10.69 cr-hrs of technical electives to take. This number is rounded down to 10 so Alice cannot lose even a fraction of a cr-hr from courses taken under quarters. She must complete all requirements of the semester program not covered by these substitutions.

Alice can see by this method that she has completed all but the requirements shown in **bold** in the sample transition worksheet: “Culture and Ideas: Ethics” (3 cr-hrs), a Gen Ed course in a category not covered under quarters (3 cr-hrs), “Discrete Math” (3 cr-hrs), “Linear Algebra” (3 cr-hrs), “Foundations II” (3 cr-hrs), “Professionalism and Ethics” (1 cr-hr), either “Software Engineering” or “Databases” (3 cr-hrs), either “Theory” or “Programming Languages” (3 cr-hrs), and a “Capstone Design” course (4 cr-hrs), plus 10 cr-hrs of technical electives. In other words, Alice still needs to complete these 36 cr-hrs under semesters in order to complete her CSE degree. Once she does this, she will be able to graduate having completed $89.33 + 36 = 125.33$ equivalent sem-cr-hrs rather than the 126 sem-cr-hrs in the new CSE major program.

It is possible—though unlikely because the semester CSE program is more flexible than the quarter program—that a student might have enough cr-hrs as of the end of Sp12 to graduate within two quarters, but might have failed to cover specific requirements rather than flexible technical electives that would take, say, two semesters to complete. We will rely on systematic advising of students during the year 2011-2012 in order to prevent this from happening.

The main issue facing students in transition is that some substitutions call for completion of a sequence of courses (**bold red italics** in the transition worksheet) to complete a semester requirement. We will use two approaches to address such problems—the most severe of which arises from CSE 221/222/321, the current introductory course sequence for CSE majors.

First, we will offer “bridge courses” in Su12 (CSE 222) and Au12 (CSE 321) in order to accommodate students who wish to start into the introductory sequence in Wi12 or Sp12. The table below shows the schedules such students will be advised to follow, depending on which quarter they start this sequence. Students who do not plan to take classes during Su12 will be advised to start with Software I in Au12 rather than taking CSE 221 in Sp12. This slight delay

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should not impact the graduation date for any such student compared to quarters, as there is enough slack in the prerequisite structure of the CSE major program to permit a student just starting into the major courses at this point enough time to “catch up”.

Wi12 (qtr)	Sp12 (qtr)	Su12 (sem)	Au12 (sem)
CSE 221	CSE 222		CSE 321 (bridge)
	CSE 221	CSE 222 (bridge)	CSE 321 (bridge)

Second, via systematic advising, we will seek to prevent students from starting into any other sequence in the transition worksheet that they cannot complete under quarters. Students planning to take CSE 360 in Sp12 will be advised to take CSE 459.21 during that quarter as well. For the Electrical and Computer Engineering courses, it is already normal for students to take both listed courses during the same quarter: one is lecture, the other a related lab. Once Mathematics has registered a transition plan to deal with the introductory engineering calculus sequence, we will advise CSE students accordingly.

It is, of course, possible that a few students will nonetheless fail to qualify for a substitution after having completed only part of the substituting sequence. For instance, a student might take CSE 360 and CSE 459.21 in Sp12 and fail one of them; or a student might fail CSE 222 in Su12. All such issues will be handled on a case-by-case basis. The student, the CSE Advising Office, and if necessary the CSE Undergraduate Studies Committee will negotiate custom arrangements to fill the gap through a combination of allowing the substitution anyway, offering independent studies to make up deficiencies, and/or very limited requirements waivers. Accreditation issues might arise if students were permitted to graduate without substantially meeting all the CSE program requirements. So, students who find their progress toward graduation impeded by *failure to meet with an advisor and complete the transition worksheet, by failure to schedule and complete courses as advised, or by a failing grade in any course*, may find themselves with little recourse. The transition worksheet will, therefore, be accompanied by a transition scheduling plan (similar to the existing College of Engineering application for graduation, which includes a three-quarter scheduling plan) that shows exactly how the student should expect to complete the program without being impeded by the switch to semesters. The student will be asked to sign their own personalized transition worksheet and transition scheduling plan at the advising appointment where such details are worked out with an academic advisor. These meetings will take place starting as soon as this proposal is officially approved.

14. Assessment Practices

We have implemented a carefully developed assessment plan that we have used over many years. Details of the plan are discussed in item 15 (submitted via the assessment plan survey form). All of the essential components of the plan will be carried over to the new program as we switch to the semester system, as they are not impacted by the change to semesters.

15. Assessment Plan on File with OAA

CSE has a detailed assessment plan on our department web site. We have filled out the on-line assessment plan and submitted it to our curricular Dean for final submission to OAA.

Attachment #1: BS CSE Proposed Program Requirements

General Education	Course Number	Cr-hrs	Completed	ABET M/S
Writing Level 1		3		
Writing Level 2		3		
Literature		3		
Arts		3		
Historical Study		3		
Social Science 1		3		
Social Science 2		3		
Culture & Ideas: Ethics		3		
Total Liberal Arts Portion of Gen Ed (= 24)		24		0

Engineering Core	Course Number	Cr-hrs	Completed	ABET M/S
Engineering Survey	Engr 1100	1		
Introduction to Engineering I	Engr 1181	2		
Introduction to Engineering II	Engr 1182	2		
Engineering Calculus I	Math	5		5
Engineering Calculus II	Math	5		5
Physics I	Phys 1131	5		5
Total Engineering Core cr-hrs (= 20)		20		15

CSE Core	Course Number	Cr-hrs	Completed	ABET M/S
Software I	CSE 2221	4		
Foundations I	CSE 2321	3		1
Systems I	CSE 2421	4		
Software II	CSE 2231	4		
Foundations II	CSE 2331	3		
Systems II	CSE 2431	3		
Professionalism and Ethics	CSE 2501	1		
Electrical and Computer Engineering I	ECE 2000	4		
Electrical and Computer Engineering II	ECE 2100	4		
Discrete Mathematics	Math	3		3
Linear Algebra	Math	3		3
Statistics	Stat	3		3
Total CSE Core cr-hrs (= 39)		39		10

CSE Core Choices	Course Number	Cr-hrs	Completed	ABET M/S
Project (one of ...)	CSE 3901 or 3902	4		
Software: Software Engineering or Databases	CSE 3231 or 3241	3		
Foundations: Theory or Programming Languages	CSE 3321 or 3341	3		
Systems: Architecture or Networking	CSE 3421 or 3461	3		
Applications: Artificial Intelligence or Graphics	CSE 3521 or 3541	3		
Capstone Design (one of ...)	CSE 5911, 5912, ...	4		
Mathematics/Statistics Elective (one of ...)		3		3
Science Elective (one of Bio, Chem, Phys, ...)		5		5
Total CSE Core Choices cr-hrs (= 28)		28		8

CSE Technical Electives	Course Number	Cr-hrs	Completed	ABET M/S
Technical Elective				
Technical Elective				
Technical Elective				
Technical Elective				
Technical Elective				
Total CSE Technical Electives cr-hrs (≥ 15 ; ≥ 8 CSE)				

Grand Total (≥ 126) 33

Attachment #2:

BSCSE (B.S. in Computer Science and Engineering)

Summer 2007 & later

CSE Core

221	4	___
222	4	___
321	4	___
360	4	___
459.XX	1	___
541	3	___
560	5	___
601	1	___
625	3	___
655	4	___
660	3	___
670	3	___
675.01	3	___
680	3	___

Total CSE Core: min 45 ___

Mathematics and Science

Math	Math 151	5	___
	Math 152	5	___
	Math 153	5	___
	Math 254	5	___
	Math 366	3	___
	Math 566	3	___
Statistics	Stat 427	3	___
	Stat 428	3	___
Science	Chem 121	5	___
	Phys 131	5	___
	Phys 132	5	___
	Biol 113 or Chem 125 or EthSci 121 or Phys 133	4-5	___

Total Math and Science: min 51 ___

Engineering

Engineering	Eng 181	3	___
	Eng 183	3	___
	ISE 504	3	___
	MSE 205 or ME 410 or ME 500	3-4	___
ECE	ECE 206	1	___
	ECE 261	3	___
	ECE 300	3	___
	ECE 309	1	___
	ECE 320	3	___
	ECE 567	2	___

Total Engineering: min 25 ___

CSE Technical Electives

See reverse side for technical options

Total CSE Tech Elects: min 30 ___

General Education Curriculum (GEC)

Oral and Written Communications

English 110.xx 5 ___

Writing 2: ___ 5 ___

Communication 321+ 5 ___

Total English and Comm: 15 ___

Minimum one course from each: Social sciences, Analysis of texts/work of art, History for a total of 25 cr hrs with no more than one from any one group or subgroup (see GEC sheet)

Social Sciences

Econ 200/201 5 ___

Arts & Humanities

Analysis of texts/works of art 5 ___

Historical Study

History 5 ___

Additional GEC from above requirements

GEC 5 ___

GEC 5 ___

Social Diversity Requirement

The second writing course or the additional social sci. course or one of the analysis of texts/works of art course must be an approved social diversity course.

Ethics Requirement

Either the additional social sci. course or one of the analysis of texts/works of art course must be an approved ethics course

Total GEC: min 40 ___

Total CSE Major: min 191 ___

BSCSE (B.S. in Computer Science and Engineering)

Technical Options — 30 cr-hrs

You must choose one of the five technical options below. Each of the first four options includes a set of Required Courses and a number of credit-hours of Elective Courses. The CSE courses that may be included in the latter are:

- Letter-graded CSE courses at the 500-level and above, unless otherwise noted in the OSU Course Bulletin;
- Up to 1 hour of 459 (in addition to that required as part of the core);
- Up to 2 hours of 693/793 combined (individual studies);
- Up to 3 hours of 699 or H783 (for honors students pursuing undergraduate research);
- Capstone course must be one of 682 or 731 or 758 or 762 or 772 or 778,786

Only one of Math 568 or Math 571 may be counted; and only one of CSE 676 or ECE 765 may be counted.

If you wish to count as an elective course one that does not meet the requirements of your chosen option, you must get prior approval from your faculty advisor.

Software Systems Option				Elective Courses			
Required Courses							
	757	3	_____	_____	_____	_____	_____
	677	3	_____	_____	_____	_____	_____
	551	3	_____	_____	_____	_____	_____
	Math 568 or Math 571 or		_____	_____	_____	_____	_____
	Math 648	3	_____	_____	_____	_____	_____
	Capstone	4	_____	_____	_____	_____	_____
	Total required courses	16		Total Elective Courses:	min	14	
Recommended capstone course is CSE 758. At least 10 credit-hours of the Elective Courses must be CSE courses listed in Technical Options above. The remainder may be either CSE courses listed in Technical Options ; or ECE 561, 761, 765, 769; ISE 573, Math 572, 575, 648; AMIS 310; BusFin 420; BusMHR 400; BusMgt 430/630, BusMkt 450.							
Hardware/Software Systems Option				Elective Courses			
Required Courses							
	677	3	_____	_____	_____	_____	_____
	ECE 561	3	_____	_____	_____	_____	_____
	Math 415 or		_____	_____	_____	_____	_____
	Math 568 or Math 571	3-4	_____	_____	_____	_____	_____
	Capstone	4	_____	_____	_____	_____	_____
	Total required courses	13/14		Total Elective Courses:	min	17-18	
Recommended capstone course in CSE Core: 778. At least 10 credit-hours of the Elective Courses must be CSE courses listed in Technical Options above. The remainder may be either CSE courses listed in Technical Options ; or ECE 761, 762, 765, 769; ISE 573; Math 572, 575, 647, 648; AMIS 310; BusFin 420; BusMHR 400; BusMgt 430/630; BusMkt 450.							
Information Systems Option				Elective Courses			
Required Courses							
	616	4	_____	_____	_____	_____	_____
	671	3	_____	_____	_____	_____	_____
	AMIS 211 or AMIS 310	5	_____	_____	_____	_____	_____
	Capstone	4	_____	_____	_____	_____	_____
	Math 568 or Math 571	3	_____	_____	_____	_____	_____
	Total required courses	19		Total Elective Courses:	min	11	
Recommended capstone course is CSE 772. At least 8 credit hours of the Elective Courses must be CSE courses listed in Technical Options above, or ISE 573.							
Information and Computation Assurance Option				Elective Courses			
Required Courses							
	551	3	_____	_____	_____	_____	_____
	651	3	_____	_____	_____	_____	_____
	677	3	_____	_____	_____	_____	_____
	678	3	_____	_____	_____	_____	_____
	Capstone	4	_____	_____	_____	_____	_____
	Math 568/571/648	3	_____	_____	_____	_____	_____
	Total required courses	19		Total Elective Courses:	min	11	
Recommended capstone course is CSE 762. At least 3 credit-hours of the Elective Courses must be CSE courses listed in Technical Options above. The remainder may be either CSE courses listed in Technical Options ; or other appropriate courses; the following may be of special interest to students pursuing this option: AMIS 531, 627, 653, 658, 659; and GEOG 607.							

BSCSE (B.S. in Computer Science and Engineering)

Individualized Option

This option requires at least 30 credit-hours of elective courses. Of these, **at least 18 credit-hours must be CSE courses**. The remaining 12 credit-hours may be CSE courses or appropriate courses from one or more other disciplines. All the CSE courses must be from among those listed in **Technical Options** above and must include a **capstone course**. The student must develop a coherent program in consultation with his/her advisor, and must get approval of the program from the advisor at least four quarters before graduation. Students in this option are encouraged to consider with their advisor how the individualized major may work in conjunction with minors from other departments.

Suggested Tracks, but not limited to these.

Graphics/Animation

CSE 581.....4

Capstone.....4 (CSE 682 or 786/694G recommended)

Choose 681,694A,781,782,784,694G,682....10

Technical electives...12

Recommended for students pursuing a minor in Studio Art; Industrial, Interior & Visual Communications Design

Artificial Intelligence

CSE 612,634,730,732,733,735,779,731/694G14

Capstone.....4 (CSE 694G or 731 recommended)

Technical Electives....12

Recommended for students pursuing a minor in Linguistics; Psychology

Advanced Studies

CSE 725/755/780.....4

CSE 760/775.....4

Math 568/571/647/648....3

Capstone.....4

Technical Electives....15

Recommended for students pursuing a minor in Mathematics

Business Information Systems

CSE 616.....4

CSE 671.....3

Capstone.....4 (CSE 772 recommended)

Business Minor....20

Business minor is required

Attachment #3:

Computer Science and Engineering
2009-2010

Name: _____ email: _____@osu.edu

YEAR	AUTUMN	WINTER	SPRING
1	Math 151.OX 5 Chemistry 121 5 Engineering 181 3 Engr 100.05 (Engr Survey) 1	CSE 221 ^a 4 Math 152.OX 5 Engineering 183 3	CSE 222 4 Math 153.OX 5 Physics 131 5
2	CSE 321 4 Math 254.OX 5 Math 366 3 Physics 132 5	CSE 360 4 Math 566 3 Physics 133/Chemistry 125/EthSci 121/or Biology 113 5/4/5/5	CSE 459.xx 1 CSE 541 3 ECE 261 3 ME 410/MSE 205/or ME 500 4/3/4
3	CSE 560 5 CSE 670 3 ECE 206 1 Stat 427 3	CSE 625 3 CSE 675.01 3 ECE 300/309 4 Stat 428 3 Tech Elec*	CSE 660 3 CSE 680 3 ECE 320 3 Tech Elec*
4	CSE 655 4 ECE 567 2 ISE 504 3 Tech Elec*	CSE 601 1 Tech Elec* Tech Elec* Tech Elec*	Tech Elec** Tech Elec* Tech Elec* Tech Elec*

GENERAL EDUCATION (40 hrs)
English & Communication Skills (15)
English 110.xx (5)
2nd Writing Course (5)
Communications 321 (5)

Students must take 25 hours across Social Sciences, Historical Study, and Arts & Humanities with a minimum of 5 hours and a maximum of 10 hours per category.

Historical Study (5-10)
____ ()
____ ()

Arts and Humanities (5-10)
____ ()
____ ()

Social Sciences (5-10)
Econ 200 or 201 ()
____ ()

Social Diversity
(May overlap with another GEC Category)
____ ()

Ethics
(May overlap with another GEC category)
____ ()

TECHNICAL ELECTIVES (30 hrs)*
Math 415.xx/568/571 (4/3/3)
**Capstone (4)
____ ()
____ ()
____ ()
____ ()

ADMISSION CONDITION
____ ()

Sub-total Core 121
General Education 40
Technical Electives 30

TOTAL HOURS 191

* Technical Elective courses should be chosen in accordance with CSE options – see the CSE Undergraduate Degree Programs Brochure

^a The Prerequisite for CSE 221 is CSE 201, CSE 202, 203, 204, 205, 294P, Eng H192 or successfully passing placement test.

Acceptance into the Computer Science and Engineering program is by formal application to students who have a minimum of 25 hours at Ohio State and a 2.0 CPHR upon completion of English 110.xx, Math 151.OX, 152.OX; CSE 221, 222(with at least C-); and two classes among Chem 121, Physics 131 & 132. Applications are accepted all quarters. See the CSE advising office (DL 374) for details.

Attachment #4:

BS CSE Proposed Advising Sheet

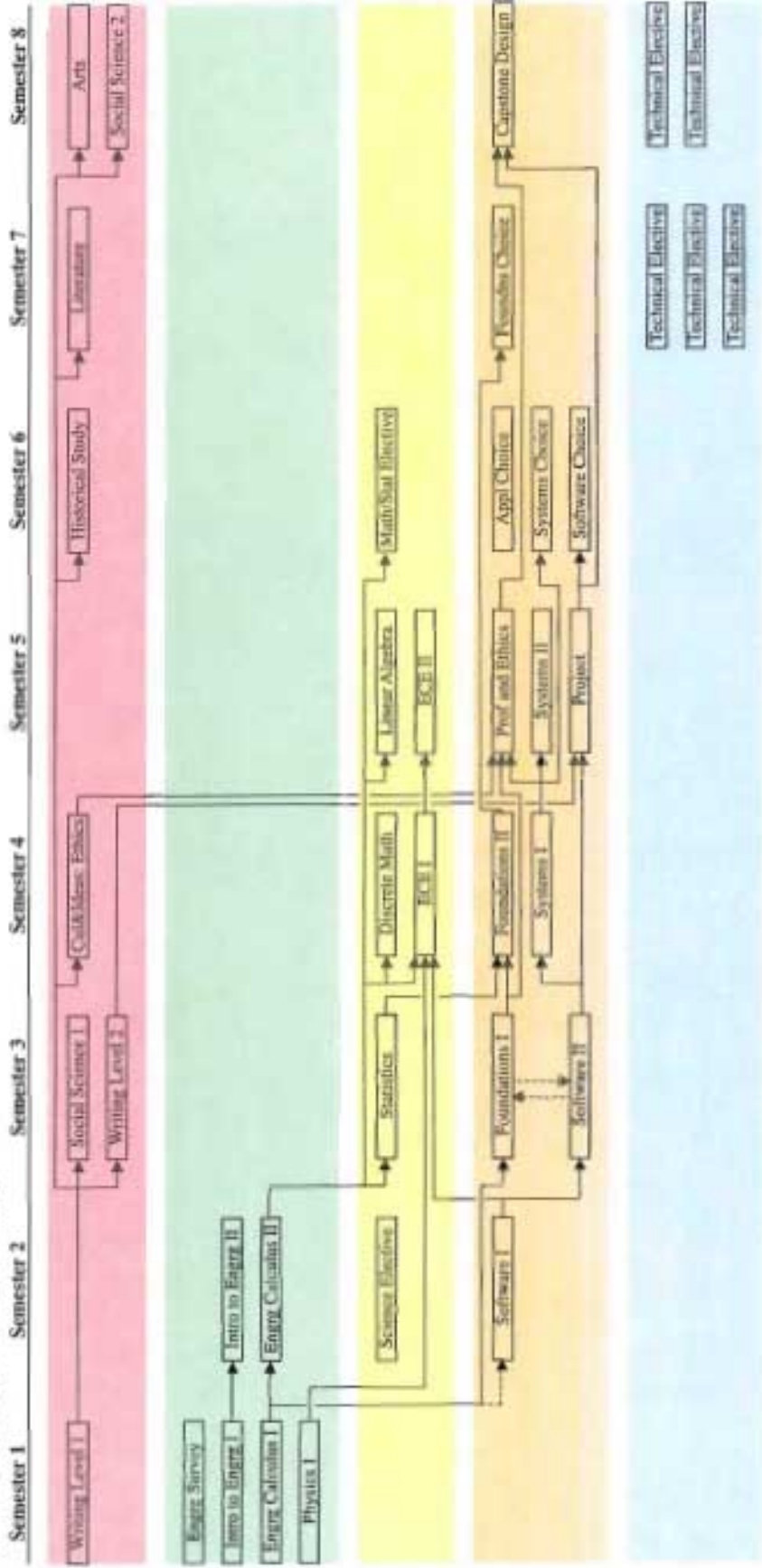
Total Cr-Hrs for BS CSE Degree: 126

Autumn (1st Semester)			Spring (2nd Semester)		
<i>Engr 1100</i>	<i>Engineering Survey</i>	1	<i>CSE 2221</i>	<i>Software I</i>	4
<i>Engr 1181</i>	<i>Introduction to Engineering I</i>	2	<i>Engr 1182</i>	<i>Introduction to Engineering II</i>	2
<i>Math</i>	<i>Engineering Calculus I</i>	5	<i>Math</i>	<i>Engineering Calculus II</i>	5
<i>Phys 1131</i>	<i>Physics I</i>	3	<i>Science</i>	<i>Science Elective: Bio, Chem, or Phys II</i>	5
<i>Gen Ed</i>	<i>Writing Level 1</i>	3			
		Total 16			Total 16
Autumn (3rd Semester)			Spring (4th Semester)		
CSE 2231	Software II	4	CSE 2331	Foundations II	3
CSE 2321	Foundations I	3	CSE 2421	Systems I	4
Stat	Statistics	3	ECE 2000	Electrical and Computer Engineering I	4
Gen Ed	Writing Level 2	3	Math	Discrete Mathematics	3
Gen Ed	Social Science 1	3	Gen Ed	Culture & Ideas: Ethics	3
		Total 16			Total 17
Autumn (5th Semester)			Spring (6th Semester)		
CSE 2431	Systems II	3	CSE	Software: Software Eng or Databases	3
CSE 2501	Professionalism and Ethics	1	CSE	Systems: Architecture or Networks	3
CSE 390x	Project	4	CSE	Applications: AI or Graphics	3
ECE 2100	Electrical and Computer Engineering II	4	Math/Stat	Mathematics/Statistics Elective	3
Math	Linear Algebra	3	Gen Ed	Historical Study	3
		Total 15			Total 15
Autumn (7th Semester)			Spring (8th Semester)		
CSE	Foundations: Theory or Prog Lang	3	CSE 591x	Capstone Design	4
	Technical Elective	3		Technical Elective	3
	Technical Elective	3		Technical Elective	3
	Technical Elective	3	Gen Ed	Arts	3
Gen Ed	Literature	3	Gen Ed	Social Science 2	3
		Total 15			Total 16

Admission to the CSE major requires:

- Completion of courses shown above in *italics* (or honors versions thereof).
- At least 15 cr-hrs earned at Ohio State.
- A CPHR of at least 2.0 (may be higher when enrollment management is in effect).
- An MPHHR (major point hour ratio), over CSE courses that can be included in the major program, of at least 2.0.
- Completion of all admission conditions that may have been imposed when the student was admitted to OSU.

**Attachment #5:
BS CSE Proposed Advising Roadmap**



**Attachment #6:
BS Computer Science and Engineering Curriculum Map: Courses to Program Outcomes
(Proposed)**

Course Number	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CSE 2221	***	*	***		**		*		*		***	**	*	***
CSE 2231	***	*	***	**	**		*		*		***	**	*	***
CSE 2321	***		**		*				*		**	**	**	
CSE 2331	***	*	**		**				**		**	**	**	*
CSE 2421	**	**	***		**						***	***	***	**
CSE 2431	**	**	**		***				*		***	**	***	**
CSE 2501					*	***	**	***	*	**				
CSE 3231	*		**	*	**	*	*	*	*	*	**	**	**	**
CSE 3241	***	*	**	***	**		*		*		***	*	*	*
CSE 3321	***		*		***				**		**	**	*	
CSE 3341	***	**	***	*	***	*	*	*	**	*	***	***	***	***
CSE 3421	***	*	**		**				*	**	*	*	**	*
CSE 3461	**	**	*	**	*	*		*	*	**	**	*	*	*
CSE 3521	***	*	**		**	*		*	*		**	**	*	**
CSE 3541	***	**	***		*	*	*	*	*	*	**	***	***	**
CSE 3901	**		***	***	**	*	**				***	*	*	**
CSE 3902	**	*	***	***	**	*	**	*	*	*	***	**	**	**

Attachment #7:
BS CSE Proposed Transition Worksheet

Bold red italics: combination required

Done?	Quarter Course Completed	q-cr-hrs	Equiv s-cr-hrs	Substitutes For	Cr-hrs	Excess cr-hrs
	Engl 110	5	3.33	Writing Level 1	3	0.33
	Second writing	5	3.33	Writing Level 2	3	0.33
	Econ 200 or Econ 201	5	3.33	Social Science 1	3	0.33
	GEC Ethics	5	3.33	Culture and Ideas: Ethics	3	0.33
	Comm 321	5	3.33	Gen Ed any	3	0.33
	GEC other	5	3.33	Gen Ed similar	3	0.33
	GEC other	5	3.33	Gen Ed similar	3	0.33
	GEC other	5	3.33	Gen Ed similar (see * below)	3	0.33
	Eng 100	1	0.67	Engineering Survey	1	-0.33
	Eng 181	3	2.00	Intro to Engineering I	2	0.00
	Eng 183	3	2.00	Intro to Engineering II	2	0.00
	<i>Math 151 and Math 152</i>	10	6.67	Engineering Calculus I	5	1.67
	Math 153	5	3.33	Engineering Calculus II	5	-1.67
	Phys 131	5	3.33	Physics I	5	-1.67
	Math 566	3	2.00	Discrete Math	3	-1.00
	Math 568 or Math 571	3	2.00	Linear Algebra	3	-1.00
	Stat 427	3	2.00	Statistics	3	-1.00
	Math 254 (+2 *) or Stat 428	3	2.00	Mathematics/Statistics Elective	3	-1.00
	Phys 132 or Chem 121 or Bio 113	5	3.33	Science Elective	5	-1.67
	<i>ECE 206 and ECE 261</i>	4	2.67	Electrical/Comp Engineering I	4	-1.33
	<i>ECE 300 and ECE 309</i>	4	2.67	Electrical/Comp Engineering II	4	-1.33
	<i>CSE 221 and CSE 222 and CSE 321</i>	12	8.00	Software I and II	8	0.00
	Math 366	3	2.00	Foundations I	3	-1.00
	CSE 680	3	2.00	Foundations II	3	-1.00
	<i>CSE 360 and (CSE 459.21 or CSE 459.22)</i>	5	3.33	Systems I	4	-0.67
	CSE 660	3	2.00	Systems II	3	-1.00
	CSE 601	1	0.67	Professionalism and Ethics	1	-0.33
	CSE 560	5	3.33	Project	4	-0.67
	CSE 757 or CSE 670	3	2.00	Software Eng/Databases	3	-1.00
	CSE 625 or CSE 655 (+1 *)	3	2.00	Theory/Prog Languages	3	-1.00
	CSE 675.01 or 675.02 or CSE 677	3	2.00	Architecture/Networking	3	-1.00
	CSE 581 (+1 *) or CSE 681 (+1 *) or CSE 630	3	2.00	Graphics/Artificial Intelligence	3	-1.00
	CSE Capstone Design	4	2.67	Capstone Design	4	-1.33
	Anything else counted now (including *)	24	16.00	Technical Electives	15	1.00

* 35 q-cr-hrs of GEC completes the Gen Ed requirement; any excess counts against technical electives.

134	89.33	Total Completed cr-hrs
	36.67	Total Remaining cr-hrs
	1.98	Excess Gen Ed cr-hrs
	10.69	Remaining Tech Elective cr-hrs

After meeting with my academic advisor, I understand the conversion of my coursework from quarters to semesters. I also understand that:

- 1) I will not be impeded toward graduation if I follow the plan put forward in this transition worksheet and the attached timetable for completion, and
- 2) if I fail to make satisfactory progress on my part, fail to schedule promptly and appropriately and complete courses as advised, and/or otherwise fail to follow this plan, graduation in a timely fashion may not be possible.

Student printed name / signature / date: _____ / _____ / _____

Advisor printed name / signature / date: _____ / _____ / _____

MS in Computer Science and Engineering (MS CSE) Program

Primary Contact: Gagan Agrawal (agrawal.28, 688-8450)

1. Name of Program

Computer Science and Engineering

2. Name of Degree

Master of Science in Computer Science and Engineering (MS CSE)

3. Responsible Academic Unit

Department of Computer Science and Engineering

4. Type of Program

d. Graduate degree program

5. Semester Conversion Designation

b. Converted with minimal changes to program goals and/or curricular requirements (e.g., name changes, changes in electives and/or prerequisites, minimal changes in overall structure of program, minimal or no changes in program goals or content)

6. Program Learning Goals

Not required at this time for graduate programs.

7. Proposed Program Requirements

See Attachments #1a and #1b: MS CSE Proposed Program Requirements. There are two tracks: a “research track” (thesis), and a “coursework track” (no thesis but may involve an MS project).

8. Current and Proposed Advising Sheets

See Attachment #2 for the current MS CSE program requirements; this is also available at <http://www.cse.ohio-state.edu/grad/ms.html>. This document serves as the current MS CSE Advising Sheet. Attachments #1a and #1b, along with a matching updated version of the on-line degree program requirements and with similar details, and included as Attachment #3, will serve as the proposed MS CSE Advising Sheet.

9. Curriculum Map

Not required at this time for graduate programs.

10. Rationale for Program Changes and Description of Changes

Our MS program requirements have been anchored in a “foundational core” and an “applied core”. Students completing the research (thesis) track currently are required to take 15 qtr-cr-hrs from the list of such core classes, and students completing the coursework (non-thesis) track are required to take 18 qtr-cr-hrs from the same list. These requirements will be replaced by 12 and 15 sem-cr-hrs, respectively, where the core in each case comprises a “graduate core” and an “applied core”. Students will be taking fewer credits (hence fewer courses, which remain

MS CSE PROGRAM PROPOSAL — 5/9/10

generally 3 cr-hrs each), so we felt we should maintain emphasis on core areas in order to preserve most of this breadth while slightly reducing electives. We have therefore realigned the MS foundational core with the PhD core to form a common graduate core. This consolidation benefits students starting in the MS program and later moving into the PhD program.

The other major change is with respect to the project option. Currently, students in the coursework (non-thesis) track may complete a two-quarter project to replace 6 graded qtr-cr-hrs. In the proposed program, students in the coursework track will have the option of completing a two-semester project to replace 6 graded sem-cr-hrs. We felt that a longer duration of the project will allow more substantial efforts, leading to a better experience for the students; and that a one-semester project would be too little, given that the current two-quarter time-frame is barely adequate to provide in-depth graduate work on such a project.

The last changes in the MS CSE programs were made in Spring 2008, when we introduced the applied core requirement and the project option for the MS non-thesis track.

11. Credit Hour Changes

	Number of qtr-cr-hrs in current program	Calculated result for 2/3 of current qtr-cr-hrs	Number of sem-cr-hrs required for proposed program
Total cr-hrs required for completion of program	45-50	30.0-33.3	30-33
Prerequisite cr-hrs required for admission to program which are not counted toward total hours	0	0.0	0
Required cr-hrs offered by the unit	36-50	24.0-33.3	24-33
Required cr-hrs offered outside of the unit	0-9	0.0-6.0	0-6

12. Rationale for Significant Change in Credit Hours

Not applicable.

13. Transition Policy

No CSE graduate student who began the degree program under quarters will have progress toward graduation impeded by the transition to semesters. Graduation requirements beginning Summer 2012 will be those in force for CSE graduate students under semesters; but *every* quarter-credit-hour that would have counted toward a CSE graduate degree under the quarter-based program will count (as 2/3 of a semester-credit-hour) toward the requirements for graduation under the corresponding semester-based program. Additional advising support will be provided for CSE graduate students to assist in planning course schedules for the last year of quarters (2011-2012) and for the first year of semesters (2012-2013). If it is determined that the “normal” conditions covered by the CSE transition policy would result in a particular student facing an unavoidable delay in graduation compared to quarters due to the change to semesters—

MS CSE PROGRAM PROPOSAL — 5/9/10

rather than the student's failure to meet with an advisor to complete a proposed plan of study or to make satisfactory progress through the mutually agreed program plan—then a revision of specific requirements will be worked out for that student by their faculty advisor, with approval by the CSE Graduate Studies Committee.

— Xiaodong Zhang, CSE Department Chair

The MS degree conversion policy has been designed so that a student finishing a requirement in the quarter system will be deemed to have met the corresponding requirement in the semester system. Total cr-hrs taken under quarters will be converted according to the usual 2/3 sem-cr-hr per qtr-cr-hr completed, and any excess or deficit in sem-cr-hrs for the degree after fulfilling the specific core requirements below will be applied to electives. A student in transition will be deemed to have enough sem-cr-hrs to graduate if his/her total sem-cr-hrs are less than 1 sem-cr-hr below the semester requirement for the applicable MS track. For example, if a research-track MS student completes the new graduate core requirements (perhaps partly or completely via the transition policy below), the new MS applied core requirements (again, perhaps partly or completely via the transition policy below), and has accumulated a total of more than 29 sem-cr-hrs of graduate credit including electives, then the student will be deemed to have satisfied the requirement for a total of 30 sem-cr-hrs. This, combined with the specific policies below, ensures that no student will lose a single qtr-cr-hr in the transition to semesters.

The current requirement for the foundational core is 3 classes totalling 9 qtr-cr-hrs. Under semesters, as seen in Attachments #1a and #1b, the new graduate core requirement will be 3 classes totalling 9 sem-cr-hrs. Any foundational core class taken in the quarter system will provide 2 sem-cr-hrs toward the MS degree, and will count as 1 class toward meeting the 3-class graduate core requirement. Any additional graduate core sem-cr-hrs missing in this conversion will be added to electives, giving students maximum flexibility for completing the cr-hr requirements for the MS degree.

The current requirement for the MS applied core is 2 classes for the research track or 3 classes for the coursework track; some of these classes are 3 qtr-cr-hrs while others are 4 qtr-cr-hrs. Under semesters, as seen in Attachments #1a and #1b, the new requirements will be 3 sem-cr-hrs or 6 sem-cr-hrs, respectively. Any applied core class of 3 qtr-cr-hrs taken in the quarter system will provide 2 sem-cr-hrs toward meeting the MS applied core requirement. Any applied core class of 4 qtr-cr-hrs will provide 3 sem-cr-hrs toward meeting the MS applied core requirement (though in this case a deficit of 0.33 sem-cr-hrs will be applied to electives).

Finally, the current limitation on “primarily undergraduate courses” will be rephrased as a limitation on “pre-core courses”. The current limit of at most 3 classes of this type will be converted to a limit of 6 sem-cr-hrs. Any cr-hrs completed under quarters and within the current limit of 3 classes will be converted directly to sem-cr-hrs and will apply against the semester program cr-hr limit, but all will be counted toward the total sem-cr-hrs required for graduation.

There are no graduate course sequences in which a student might be caught part-way during the switch to semesters, so there is no need for bridge courses in the CSE graduate programs.

14. Assessment Practices

Not required at this time for graduate programs.

15. Assessment Plan on File with OAA

Not required at this time for graduate programs.

Attachment #1a:

MS CSE Proposed Program Requirements: Research Track

Graduate Pre-Core (note 1)	Course Number	Cr-hrs	Graded cr-hrs
Total Graduate Pre-Core cr-hrs (≤ 6)			

Graduate Core	Course Number	Cr-hrs	Graded cr-hrs
Algorithms	CSE 6332	3	3
Computability and Complexity <i>or</i> Programming Languages	CSE 6322 or 6342	3	3
Computer Architecture <i>or</i> Operating Systems	CSE 6422 or 6432	3	3
Total Graduate Core cr-hrs ($= 9$)		9	9

Applied Core (note 2)	Course Number	Cr-hrs	Graded cr-hrs
Total MS Applied Core cr-hrs (≥ 3)			

MS Thesis Research (note 3)	Course Number	Cr-hrs	Graded cr-hrs
			0
			0
			0
			0
Total MS Thesis Research cr-hrs (≥ 6)			0

MS Electives (note 4)	Course Number	Cr-hrs	Graded cr-hrs	Non-CSE cr-hrs
Total MS Electives cr-hrs				

Research Track with Thesis cr-hrs (total ≥ 30, graded ≥ 20, non-CSE ≤ 6)				
---	--	--	--	--

Notes:

- (1) Pre-core courses are currently: CSE 5231, 5241, 5321, 5331, 5341, 5421, 5431, 5461, 5501, 5521, 5541, 5901, 5902
- (2) Applied core courses will be determined by the CSE Graduate Studies Committee
- (3) See MS program description for MS thesis research and thesis requirements
- (4) Any CSE course at 5000-level or above, except pre-core; or other GSC-approved graduate course

Attachment #1b:

MS CSE Proposed Program Requirements: Coursework Track

Graduate Pre-Core (note 1)	Course Number	Cr-hrs	Graded cr-hrs
Total Graduate Pre-Core cr-hrs (≤ 6)			

Graduate Core	Course Number	Cr-hrs	Graded cr-hrs
Algorithms	CSE 6332	3	3
Computability and Complexity <i>or</i> Programming Languages	CSE 6322 or 6342	3	3
Computer Architecture <i>or</i> Operating Systems	CSE 6422 or 6432	3	3
Total Graduate Core cr-hrs (= 9)		9	9

Applied Core (note 2)	Course Number	Cr-hrs	Graded cr-hrs
Total MS Applied Core cr-hrs (≥ 6)			

MS Project (optional) (note 3)	Course Number	Cr-hrs	Graded cr-hrs
			0
			0
Total MS Project cr-hrs (= 0 or = 6)			0

MS Electives (note 4)	Course Number	Cr-hrs	Graded cr-hrs	Non-CSE cr-hrs
Total MS Electives cr-hrs				

Coursework Track w/ Project cr-hrs (total ≥ 33 , graded ≥ 24 , non-CSE ≤ 6)

Coursework Track w/o Project cr-hrs (total ≥ 33 , graded ≥ 30 , non-CSE ≤ 6)

Notes:

- (1) Pre-core courses are currently: CSE 5231, 5241, 5321, 5331, 5341, 5421, 5431, 5461, 5501, 5521, 5541, 5901, 5902
- (2) Applied core courses will be determined by the CSE Graduate Studies Committee
- (3) See MS program description for details of MS project requirements
- (4) Any CSE course at 5000-level or above, except pre-core; or other GSC-approved graduate course

* Last Updated: April 2008

** [printer-friendly version](#)

Note: This version of the requirements applies for all students joining the program from Fall 2008 onwards. Students joining the program prior to that may choose to follow these requirements, or the requirements stated in the version last updated [November 2004](#).

■ MASTER OF SCIENCE PROGRAM

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■ FOREWORD

This document together with the Graduate School Handbook, current edition, gives the complete statement of the official requirements for the Master of Science degree in Computer Science and Engineering. These requirements and the procedures for obtaining the degree are determined in part by the Graduate School, and in part by the Department. Petitions for exception to these requirements should be channeled through the departmental Graduate Studies Committee.

Students in the M.S. program must be regular students as defined by the Graduate School regulations; special students and students enrolled in Continuing Education are not considered as regular students. In order to qualify for admission as regular students, students must first remove any restrictions placed on their status. Removal of restrictions is regulated by the Graduate School and the Departmental Graduate Studies Committee.

The procedures and requirements described herein are subject to revision. Students should consult materials issued periodically by the Graduate School and the Department, their advisors, or the Chair of the Graduate Studies Committee for any changes or interpretation of policy.

■ PROGRAM FOR THE MASTER OF SCIENCE DEGREE IN CSE

The program's philosophy is to provide students a broad graduate level education in the fundamentals of Computer Science and Engineering and also provide the opportunity for deeper study in a specialized sub-area of interest to the student. Students work out the details of their program in close consultation with their advisors.

Two options are offered:

- Thesis Option (Research Track)
- Non-Thesis Option (Coursework Track)

Program requirements for the Thesis Option and Non-Thesis Option are detailed in this document. The terms "Research Track" and "Thesis Option" are used interchangeably in this document. Similarly, the terms "Coursework Track" and "Non-Thesis Option" are used synonymously.

■ 1 ADVISORS

Students' degree programs and all courses taken by students must be approved by their academic advisors. Each student admitted to the graduate program in Computer Science and Engineering is assigned a tentative academic advisor. Students should consult their advisors as soon as possible after arriving on campus, and periodically thereafter until, upon developing a specific specialty interest, a permanent advisor is chosen in that specialty area. When a student determines that his/her interests lie in a particular specialty area, he/she should choose a permanent faculty advisor in that area.

This choice should be made as soon as practical, especially for students planning either to undertake thesis research or to enter the Ph.D. program. Students whose specialty interests change should consider changing to an advisor whose field encompasses their new interests. In exceptional cases, members of other departments who hold joint appointments as Graduate Faculty members of this Department may serve as research advisors for students, but in all cases, the student's academic advisor must be a faculty member whose primary faculty appointment is in this Department.

In addition to the above departmental academic and research advising, the Graduate School maintains a counseling office for students.

■ 2 REQUIREMENTS FOR THE M.S. DEGREE IN COMPUTER SCIENCE AND ENGINEERING

This section contains a list of requirements for the Master of Science Degree in Computer Science and Engineering. Students are advised to check the latest edition of the Graduate School Handbook for possible added requirements.

2.1 CREDIT HOURS

The minimum number of quarter credit hours required for the M.S. Degree is as follows:

- Research Track (Requires Thesis): 45 credits
- Coursework Track (No thesis): 50 credits

Students in either track must satisfy the Core Requirement (Sec. 2.2). Additional requirements are listed in Sec. 2.2.1 for the Research Track and in Sec. 2.2.2 for the Coursework Track. Students transferring credits for their degree should note the requirements in Section 2.4 below.

2.2 DEGREE PROGRAM

Each candidate is required to pursue a program of study in courses approved by his/her academic advisor. Students in the non-thesis track need to complete 30 graded credits. Students in the non-thesis track need to complete 45 graded credits, or 39 graded credits and a masters project, as detailed in Section 2.4. For students in either track, at most 9 credits from classes taken outside of CSE may count towards these requirements. These classes must be from disciplines closely related to CSE, and need to be approved in advance by the student's advisor.

600-800 level letter-graded CSE classes will be considered to be of four types:

- Primarily Undergraduate Classes: These classes include CSE 616, 625, 630, 655, 660, 670, 675, 677, and 680. This list will be periodically updated by the graduate studies committee. Both non-thesis and thesis students are limited to taking at most 3 classes from this group, to count towards their 30/45 graded credit requirement.
- Foundation Core: This group includes 725, 755, 760, 775, and 780. Note that the department also offers an undergraduate class in each of these areas - 625, 655, 660, 675, and 680, which

are referred to as pre-core classes. All students need to pass at least three of the five foundational core classes, including 780 and at least one of 760 and 775. In the area where a student does not take a foundational core class, he/she must take the pre-core class, or show that they have taken an equivalent class before coming to OSU.

- Applied Core: This group currently includes 621, 678, 681, 730, 756, and 770. This list will be periodically updated by the graduate studies committee. One software engineering class is likely to be added in the near future. Students in the thesis option must take at least two classes from this group, and students in the non-thesis option must take at least three classes from this group.
- All other 600-800 level letter-graded classes offered by the CSE department. There are no minimum or maximum requirements, except that non-thesis students not taking the project option (see below) must take at least one class that counts for capstone requirements for the BS CSE program.

Students who are able to transfer graduate credit for these classes or who took equivalent courses as undergraduates may substitute other appropriate courses in their program, with the approval of their advisors.

2.2.1 Additional Requirements: Research Track

- Master Thesis: All students in the Research Track are required to complete a Master's Thesis (Sec. 3).
- Research course requirement: Students are required to register for at least 3 credits of research (788/793/888/999) every quarter, from their second quarter onwards.
- Letter graded course requirement: At least 30 of the credit hours applied toward the degree must be from letter graded courses. (Core courses are letter graded and count toward this 30 credit requirement.)
- CIS 885: Students are required to complete CIS 885 (Seminar on research topics in CSE.)

2.2.2 Additional Requirements: Coursework Track

- CIS 885: Students are required to complete CIS 885 (Seminar on research topics in CSE.)

2.3 THESIS

Each student on the Research Track must submit an approved thesis, based on appropriate research experience, in accordance with Departmental and Graduate School regulations. The Master's thesis must be produced under the direction and with the approval of the student's research advisor, who must be a member of the Graduate Faculty. The Graduate School Handbook should be consulted for rules, procedures, and deadlines for preparation and submission of the final approved copy of the thesis.

Each candidate (in either the Research Track or Coursework Track) must also pass a Master's Examination to test his/her knowledge of the course of study pursued. The rules governing the Master's Examination are given in Section 3.

2.4 PROJECT OPTION

Masters non-thesis students may take 6 S/U credits (793 or 888) over two consecutive quarters to complete a substantial implementation project with a CSE faculty member. A 3-4 page write-up on the features of the software and design choices must be completed and approved by the CSE faculty member supervising the project. This write-up should be included with the masters paperwork for the student. These credits will count towards the 45 graded course requirement.

2.5 RESIDENCY and TRANSFER CREDIT

Satisfactory completion of 36 hours of graduate credit (Research Track), or 42 hours of graduate credit

(Coursework Track), over a minimum of two quarters at this university, is required. Students who transfer credits from other departments or other universities in order to qualify for the degree, must submit their Request for Application or Transfer of Credit no later than the second quarter of enrollment in the graduate school.

2.6 ACADEMIC STANDARDS

A graduate student must maintain at least a B (3.00) average in all graduate credit courses, with no more than one-third of the credit hours with grades of C or lower. Students whose performance falls below the above standard are subject to the Graduate School rules which apply to probationary status or dismissal. In addition, a graduate student must maintain at least a B (3.00) average in all courses applied towards the student's CSE degree.

Only courses in which a graduate student has received a C (2.00) or higher may be applied to the student's CSE degree.

2.7 APPLICATION TO GRADUATE and DECLARATION OF EXAMINATION FORMS

Students must submit an "Application to Graduate" form to the department office by the seventh Friday of the quarter preceding the quarter of expected graduation. All students desiring the Master of Science degree must file a Declaration of Examination form with the Chair of the Department's M.S. Comprehensive Examination Committee by the seventh week of the quarter prior to the quarter in which the degree is sought. These forms, and instructions for their use, are available in the Department office. Both forms require approval by the student's academic advisor before submission to the Department. Failure to submit these forms on time will usually result in the student not being able to graduate in the quarter desired.

No student will be allowed to take the Master's examination until he or she has received graduate credit for at least 24 quarter hours at this university and reasonably can be expected to complete all of the requirements for the Master's degree in the quarter for which the "Application to Graduate" form is filed. Students are expected, however to take the Master's examination by the time they have completed 50 credit hours. Any exceptions to this rule must be petitioned to the Graduate Studies Committee.

2.8 TIME LIMIT

The entire work for the Master's degree must be completed within a period of six calendar years. In the case of students who take all the work for the Master's degree during summer quarters, the above rule will be interpreted to include the seventh Summer Quarter.

■ 3 MASTER'S EXAMINATION

A Master's Examination is required to test the candidate's knowledge of the courses of study he/she has pursued. Students must have filed an "Application to Graduate" form (Section 2.5) before they can take this examination.

If a student fails to perform satisfactorily on the Master's Examination and desires to take it again in order to get the Master's degree, he/she must enroll the following quarter for at least three credits and take the final examination in that quarter. Any exceptions to this rule must have the approval of the Graduate Studies Committee. In accordance with Graduate School regulations, no student will be permitted to take this examination a third time.

Sections 3.1 and 3.2 describe the details concerning the format and scheduling of the Master's Examination for students on the Research Track and Coursework Track.

3.1 Research Track (Thesis Option)

The Master's Examination is held after the draft of the thesis is approved. Final thesis approval occurs

after the examination. The examination must be oral and may include a written portion, at the option of the examination committee. The chair of the committee is to be the candidate's research advisor, and the committee must include at least one other member of the committee who is a member of the Graduate Faculty with primary appointment in the CSE Department. The Graduate Studies Committee may appoint additional members of the committee if it considers it necessary. The committee chair is responsible for arranging and conducting the examination, which is to be based on the subject matter of the thesis as well as the course of study which the candidate has pursued. The chair of the examining committee is also responsible for certifying the examination results and reporting them to the Graduate Studies Committee and the Graduate School office within the prescribed time set by the Graduate School.

3.2 Coursework Track (Non-Thesis Option)

All candidates on the Coursework Track must pass a written comprehensive examination composed of examinations in three of the five core areas. These exams are based on the 700 level graduate core classes. All students must take the exam based on CSE 780, and at least one from the exams based on CSE 760 and CSE 775. The candidate must specify which areas they will take the exam in when completing the declaration of examination form. Examination in each of the areas is of 90 minute duration, and these examinations are administered over a 2 day duration. Currently, these exams are offered in Autumn and Spring Quarters.

■ 4 MASTER'S DEGREE ON BASIS OF PH.D. CANDIDACY EXAMINATION

Ph.D. students who have not previously obtained a Master's degree in Computer Science and Engineering may be recommended for the Master of Science degree after taking their Ph.D. Candidacy Examinations under the following conditions:

It is recommended by the student's advisor and the Graduate Studies Committee; The student does not already hold an equivalent master's degree in the same field; Graduation deadlines established by the Graduate School are met. The Graduate School Handbook is to be consulted for the applicable procedural details.

* Last Updated: May 2010

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MASTER OF SCIENCE PROGRAM

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FOREWORD

This document together with the Graduate School Handbook, current edition, gives the complete statement of the official requirements for the Master of Science degree in Computer Science and Engineering. These requirements and the procedures for obtaining the degree are determined in part by the Graduate School, and in part by the Department. Petitions for exception to these requirements should be channeled through the departmental Graduate Studies Committee.

Students in the M.S. program must be regular students as defined by the Graduate School regulations; special students and students enrolled in Continuing Education are not considered as regular students. In order to qualify for admission as regular students, students must first remove any restrictions placed on their status. Removal of restrictions is regulated by the Graduate School and the Departmental Graduate Studies Committee.

The procedures and requirements described herein are subject to revision. Students should consult materials issued periodically by the Graduate School and the Department, their advisors, or the Chair of the Graduate Studies Committee for any changes or interpretation of policy.

PROGRAM FOR THE MASTER OF SCIENCE DEGREE IN CSE

The program's philosophy is to provide students a broad graduate level education in the fundamentals of Computer Science and Engineering and also provide the opportunity for deeper study in a specialized sub-area of interest to the student. Students work out the details of their program in close consultation with their advisors.

Two options are offered:

- Thesis Option (Research Track)
- Non-Thesis Option (Coursework Track)

Program requirements for the Thesis Option and Non-Thesis Option are detailed in this document. The terms "Research Track" and "Thesis Option" are used interchangeably in this document. Similarly, the terms "Coursework Track" and "Non-Thesis Option" are used synonymously.

1 ADVISORS

Students' degree programs and all courses taken by students must be approved by their academic advisors. Each student admitted to the graduate program in Computer Science and Engineering is assigned a tentative academic advisor. Students should consult their advisors as soon as possible after arriving on campus, and periodically thereafter until, upon developing a specific specialty interest, a permanent advisor is chosen in that specialty area. When a student determines that his/her interests lie in a particular specialty area, he/she should choose a permanent faculty advisor in that area.

This choice should be made as soon as practical, especially for students planning either to undertake thesis research or to enter the Ph.D. program. Students whose specialty interests change should consider changing to an advisor whose field encompasses their new interests. In exceptional cases, members of other departments who hold joint appointments as Graduate Faculty members of this Department may serve as research advisors for students, but in all cases, the student's academic advisor must be a faculty member whose primary faculty appointment is in this Department.

In addition to the above departmental academic and research advising, the Graduate School maintains a counseling office for students.

2 REQUIREMENTS FOR THE M.S. DEGREE IN COMPUTER SCIENCE AND ENGINEERING

This section contains a list of requirements for the Master of Science Degree in Computer Science and Engineering. Students are advised to check the latest edition of the Graduate School Handbook for possible added requirements.

2.1 CREDITS

The minimum number of cr-hrs required for the M.S. Degree is as follows:

- Research Track (requires thesis): 30 cr-hrs
- Coursework Track (no thesis): 33 cr-hrs

Students in either track must satisfy the course requirements listed in Sec. 2.2.

2.2 DEGREE PROGRAM

Each candidate is required to pursue a program of study in courses approved by his/her academic advisor. Students in the thesis track need to complete 20 graded cr-hrs. Students in the non-thesis track need to complete 30 graded cr-hrs, or 24 graded cr-hrs and a masters project, as detailed in Section 2.4. For students in either track, at most 6 cr-hrs from classes taken outside of CSE may count towards these requirements. These classes must be from disciplines closely related to CSE, and need to be approved in advance by the student's advisor.

For meeting the course requirements for both research and coursework track masters programs, letter-graded classes at the 5000-level and above will be considered to be of four types:

- Graduate Pre-Core: These classes include graduate versions of classes that are either required for the CSE undergrad degree or are in a "pick-list" in the requirements for the CSE undergrad degree. These graduate versions will typically be offered for fewer cr-hrs than the equivalent undergrad courses. The list currently includes the following CSE courses: CSE 5232, CSE 5241, CSE 5321, CSE 5331, CSE 5421, CSE 5431, CSE 5461, and CSE 5521. Both non-thesis and thesis students are limited to taking at most 6 cr-hrs from this group, to count towards their 20/24/30 graded cr-hr requirements.
- Graduate Core: This group includes graduate classes on algorithms, computability and unsolvability, programming languages, computer architecture, and operating systems. Specifically, these classes are numbered CSE 6321, CSE 6331, CSE 6341, CSE 6421, and CSE 6431. All students must pass 3 foundational core classes, including algorithms, either computability and unsolvability or programming languages, and either computer architecture or operating systems.
- Applied Core: The following courses are included in this list: CSE 5242, CSE 5343, CSE 5441, CSE 5462, CSE 5522, and CSE 6231. Students in the thesis option must take at least one class from this

- group, and students in the non-thesis option must take at least two classes from this group.
- All other letter-graded classes offered by the CSE department at the 5000-level or above, or non-CSE graduate courses approved by the Graduate Studies Committee. These classes can be taken, together with the requirements and restrictions on pre-core, graduate core, and applied core, towards meeting the 20/24/30 graded cr-hr requirements.

Students who are able to transfer graduate credit for these classes or who took equivalent courses as undergraduates may substitute other appropriate courses in their program, with the approval of their advisors.

2.3 THESIS

Each student on the Research Track must submit an approved thesis, based on appropriate research experience, in accordance with Departmental and Graduate School regulations. The Master's thesis must be produced under the direction and with the approval of the student's research advisor, who must be a member of the Graduate Faculty. The Graduate School Handbook should be consulted for rules, procedures, and deadlines for preparation and submission of the final approved copy of the thesis.

Each candidate (in either the Research Track or Coursework Track) must also pass a Master's Examination to test his/her knowledge of the course of study pursued. The rules governing the Master's Examination are given in Section 3.

2.4 PROJECT OPTION

Masters non-thesis students may take 6 S/U cr-hrs over two consecutive semesters to complete a substantial implementation project with a CSE faculty member. During the first of these two semesters, students may register for independent study cr-hrs with their project advisor, but they must register for 1-5 cr-hrs of a masters project course for the second semester. A 3-4 page write-up on the features of the software and the design choices made must be completed and approved by the CSE faculty member supervising the project. This write-up should be included with the masters paperwork for the student. These 6 cr-hrs will count towards the 30 graded cr-hr requirements for non-thesis students.

2.5 RESIDENCY and TRANSFER CREDIT

Satisfactory completion of 24 cr-hrs of graduate credit (Research Track), or 27 cr-hrs of graduate credit (Coursework Track), over a minimum of two semesters at this university, is required. Students who transfer cr-hrs from other departments or other universities in order to qualify for the degree, must submit their Request for Application or Transfer of Credit no later than the second semester of enrollment in the graduate school.

2.6 ACADEMIC STANDARDS

A graduate student must maintain at least a B (3.00) average in all graduate credit courses, with no more than one-third of the cr-hrs with grades of C or lower. Students whose performance falls below the above standard are subject to the Graduate School rules which apply to probationary status or dismissal. In addition, a graduate student must maintain at least a B (3.00) average in all courses applied towards the student's CSE degree.

Only courses in which a graduate student has received a C (2.00) or higher may be applied to the student's CSE degree.

2.7 APPLICATION TO GRADUATE and DECLARATION OF EXAMINATION FORMS

Students must submit an "Application to Graduate" form to the department office by second Monday of the semester of expected graduation. For non-thesis option, a Declaration of Examination form with the Chair of the Department's M.S. Comprehensive Examination Committee by the eleventh week of the semester prior to the semester in which the degree is sought. These forms, and instructions for their

use, are available in the Department office. Both forms require approval by the student's academic advisor before submission to the Department. Failure to submit these forms on time will usually result in the student not being able to graduate in the semester desired.

No student will be allowed to take the Master's examination until he or she has received graduate credit for at least 16 cr-hrs at this university and reasonably can be expected to complete all of the requirements for the Master's degree in the semester for which the "Application to Graduate" form is filed. Students are expected, however to take the Master's examination by the time they have completed 33 cr-hrs. Any exceptions to this rule must be petitioned to the Graduate Studies Committee.

2.8 TIME LIMIT

The entire work for the Master's degree must be completed within a period of six calendar years.

3 MASTER'S EXAMINATION

A Master's Examination is required to test the candidate's knowledge of the courses of study he/she has pursued. Students must have filed an "Application to Graduate" form (Section 2.7) before they can take this examination.

If a student fails to perform satisfactorily on the Master's Examination and desires to take it again in order to get the Master's degree, he/she must enroll the following semester for at least 3 cr-hrs and take the final examination in that semester. Any exceptions to this rule must have the approval of the Graduate Studies Committee. In accordance with Graduate School regulations, no student will be permitted to take this examination a third time.

Sections 3.1 and 3.2 describe the details concerning the format and scheduling of the Master's Examination for students on the Research Track and Coursework Track.

3.1 Research Track (Thesis Option)

The Master's Examination is held after the draft of the thesis is approved. Final thesis approval occurs after the examination. The examination must be oral and may include a written portion, at the option of the examination committee. The chair of the committee is to be the candidate's research advisor, and the committee must include at least one other member of the committee who is a member of the Graduate Faculty with primary appointment in the CSE Department. The Graduate Studies Committee may appoint additional members of the committee if it considers it necessary. The committee chair is responsible for arranging and conducting the examination, which is to be based on the subject matter of the thesis as well as the course of study which the candidate has pursued. The chair of the examining committee is also responsible for certifying the examination results and reporting them to the Graduate Studies Committee and the Graduate School office within the prescribed time set by the Graduate School.

3.2 Coursework Track (Non-Thesis Option)

All candidates on the Coursework Track must pass a written comprehensive examination composed of examinations in three of the five core areas, specifically, algorithms, either of computability and unsolvability or programming languages, and either of computer architecture or operating systems. Examination in each of the areas is of 120 minute duration, and these examinations are administered over a two day duration.

4 MASTER'S DEGREE ON BASIS OF PH.D. CANDIDACY EXAMINATION

Ph.D. students who have not previously obtained a Master's degree in Computer Science and Engineering may be recommended for the Master of Science degree after taking their Ph.D. Candidacy Examinations under the following conditions:

- It is recommended by the student's advisor and the Graduate Studies Committee.

- The student does not already hold an equivalent master's degree in the same field.
- Graduation deadlines established by the Graduate School are met.

The Graduate School Handbook is to be consulted for the applicable procedural details.

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If you have trouble accessing this page, contact [webmaster](#)

Attachment #4
List of all CSE Graduate Courses

CSE 5231	Software Engineering Techniques	3.0	
CSE 5232	Software Requirements Analysis	2.0	
CSE 5234	Distributed Enterprise Computing	3.0	
CSE 5235	Applied Enterprise Service Architectures		3.0
CSE 5236	Mobile Application Development	3.0	
CSE 5239	Intermediate Studies in Software Engineering	2.0	
CSE 5241	Introduction to Database Systems	2.0	
CSE 5242	Advanced Database Management Systems	3.0	
CSE 5243	Introduction to Data Mining	3.0	
CSE 5245	Introduction to Network Science	3.0	
CSE 5249	Intermediate Studies in Databases	2.0	
CSE 5321	Automata and Formal Languages	2.0	
CSE 5331	Foundations II: Data Structures and Algorithms	2.0	
CSE 5339	Intermediate Studies in Algorithms	2.0	
CSE 5341	Principles of Programming Languages	2.0	
CSE 5343	Compiler Design and Implementation	3.0	
CSE 5349	Intermediate Studies in Programming Languages	2.0	
CSE 5351	Introduction to Cryptography	3.0	
CSE 5359	Intermediate Studies in Cryptography	2.0	
CSE 5361	Numerical Methods	3.0	
CSE 5421	Introduction to Computer Architecture	2.0	
CSE 5429	Intermediate Studies in Computer Architecture		
CSE 5431	Systems II: Introduction to Operating Systems		
CSE 5433	Operating Systems Laboratory	3.0	
CSE 5439	Intermediate Studies in Operating Systems		2.0

CSE 5441	Introduction to Parallel Computing	3.0
CSE 5449	Intermediate Studies in Parallel Computing	2.0
CSE 5461	Computer Networking and Internet Technologies	2.0
CSE 5462	Network Programming	3.0
CSE 5463	Introduction to Wireless Networking	3.0
CSE 5469	Intermediate Studies in Computer Networking	2.0
CSE 5471	Information Security	3.0
CSE 5472	Information Security Projects	3.0
CSE 5473	Network Security	3.0
CSE 5479	Intermediate Studies in Computer Security	2.0
CSE 5501	Social, Ethical, and Professional Issues in Computing	1.0
CSE 5521	Survey of Artificial Intelligence I: Basic Techniques	3.0
CSE 5522	Survey of Artificial Intelligence II: Advanced Techniques	3.0
CSE 5523	Machine Learning and Statistical Pattern Recognition	3.0
CSE 5524	Computer Vision for Human-Computer Interaction	3.0
CSE 5525	Foundations of Speech and Language Processing	3.0
CSE 5526	Introduction to Neural Networks	3.0
CSE 5531	Introduction to Cognitive Science	3.0
CSE 5532	Proseminar in Cognitive Science	2.0
CSE 5539	Intermediate Studies in Artificial Intelligence	
CSE 5541	Computer Game and Animation Techniques	2.0
CSE 5542	Real-Time Rendering	3.0
CSE 5543	Geometric Modeling	3.0
CSE 5544	Introduction to Scientific Visualization	3.0
CSE 5545	Advanced Computer Graphics	3.0
CSE 5559	Intermediate Studies in Computer Graphics	2.0

CSE 5911	Capstone Design: Software Applications	4.0
CSE 5912	Capstone Design: Game Design and Development	4.0
CSE 5913	Capstone Design: Computer Animation	4.0
CSE 5914	Capstone Design: Knowledge-Based Systems	4.0
CSE 5915	Capstone Design: Information Systems	4.0
CSE 6193	Individual Studies in Computer Science and Engineering	
	1.0 - 10.0	
CSE 6194	Group Studies in Computer Science and Engineering	1.0
	- 10.0	
CSE 6231	Formal Foundations of Software Engineering	3.0
CSE 6239	Advanced Studies in Software Engineering	1.0 - 3.0
CSE 6249	Advanced Studies in Databases	1.0 - 3.0
CSE 6321	Computability and Complexity	3.0
CSE 6329	Advanced Studies in Computation Theory	1.0 - 3.0
CSE 6331	Algorithms	3.0
CSE 6332	Advanced Algorithms	3.0
CSE 6333	Distributed Algorithms	3.0
CSE 6339	Advanced Studies in Algorithms	1.0 - 3.0
CSE 6341	Foundations of Programming Languages	3.0
CSE 6349	Advanced Studies in Programming Languages	1.0 - 3.0
CSE 6359	Advanced Studies in Cryptography	1.0 - 3.0
CSE 6421	Computer Architecture	3.0
CSE 6422	Advanced Computer Architecture	3.0
CSE 6429	Advanced Studies in Computer Architecture	1.0 - 3.0
CSE 6431	Advanced Operating Systems	3.0
CSE 6439	Advanced Studies in Operating Systems	1.0 - 3.0
CSE 6441	Parallel Computing	3.0
CSE 6449	Advanced Studies in Parallel Computing	1.0 - 3.0
CSE 6461	Computer Communication Networks	3.0

CSE 6469	Advanced Studies in Computer Networking	1.0 - 3.0
CSE 6479	Advanced Studies in Computer Security	1.0 - 3.0
CSE 6539	Advanced Studies in Artificial Intelligence	1.0 - 3.0
CSE 6559	Advanced Studies in Computer Graphics	1.0 - 3.0

PhD in Computer Science and Engineering (PhD CSE) Program

Primary Contact: Gagan Agrawal (agrawal.28, 688-8450)

1. Name of Program

Computer Science and Engineering

2. Name of Degree

Doctor of Philosophy in Computer Science and Engineering (PhD CSE)

3. Responsible Academic Unit

Department of Computer Science and Engineering

4. Type of Program

d. Graduate degree program

5. Semester Conversion Designation

b. Converted with minimal changes to program goals and/or curricular requirements (e.g., name changes, changes in electives and/or prerequisites, minimal changes in overall structure of program, minimal or no changes in program goals or content)

6. Program Learning Goals

Not required at this time for graduate programs.

7. Proposed Program Requirements

See Attachment #1: PhD CSE Proposed Program Requirements.

8. Current and Proposed Advising Sheets

See Attachment #2 for the current PhD CSE program requirements; this is also available at <http://www.cse.ohio-state.edu/grad/phd.html>. This document serves as the current PhD CSE Advising Sheet. Attachment #1, along with a matching updated version of the on-line degree program requirements and with similar details, and included as Attachment #3, will serve as the proposed PhD CSE Advising Sheet.

9. Curriculum Map

Not required at this time for graduate programs.

10. Rationale for Program Changes and Description of Changes

The most significant component of the PhD program is research, leading to a dissertation, that a PhD student conducts under the supervision of their advisor(s). This component of the PhD program is not impacted by the change from quarters to semesters.

To prepare students for research, and to ensure that a PhD graduate has sufficient breadth across multiple sub-areas of computer science (and related fields), our current program includes a PhD core plus coursework in one major and two minor areas. These requirements add to 48 qtr-cr-

PHD CSE PROGRAM PROPOSAL — 5/9/10

hrs. The proposed semester plan adds to 31 sem-cr-hrs, very closely aligned to the previous requirements after the usual conversion factor of 2/3 is applied.

In developing more specific details, we felt that there was no option but to replace some breadth with depth. The PhD core currently consists of 5 required classes that are 3 qtr-cr-hrs each. The proposed graduate core consists of 5 classes that will be 3 sem-cr-hrs each, but students will be allowed to choose 3 of these 5 classes (subject to certain restrictions that continue to enforce some breadth). While this change clearly compromises the breadth of material that will be mastered by PhD students, the program will be closely aligned with those offered by peer institutions that run on a semester calendar. On the positive side, semester courses in the graduate core will offer more depth within their respective areas than with quarter courses.

The coursework for the PhD major area will be converted directly from 15 qtr-cr-hrs to 10 sem-cr-hrs. Similarly, for each of the two PhD minors, 9 qtr-cr-hrs are replaced by 6 sem-cr-hrs.

The last substantial change in PhD program requirements was made in April 2004. At that time, the credits required in major and minor areas were reduced. The goal was to allow students to get more actively involved in research earlier in the program. The change was also based on a careful survey of peer programs, which led to the conclusion that our PhD coursework requirements prior to 2004 were higher than almost all peer programs.

11. Credit Hour Changes

	Number of qtr-cr-hrs in current program	Calculated result for 2/3 of current qtr-cr-hrs	Number of sem-cr-hrs required for proposed program
Total cr-hrs required for completion of program	120	80.0	80
Prerequisite cr-hrs required for admission to program which are not counted toward total hours	0	0.0	0
Required cr-hrs offered by the unit	102-120	68.0-80.0	68-80
Required cr-hrs offered outside of the unit	0-18	0.0-12.0	0-12

12. Rationale for Significant Change in Credit Hours

Not applicable.

13. Transition Policy

No CSE graduate student who began the degree program under quarters will have progress toward graduation impeded by the transition to semesters. Graduation requirements beginning Summer 2012 will be those in force for CSE graduate students under semesters; but *every* quarter-credit-hour that would have counted toward a CSE graduate degree under the quarter-based program will count (as 2/3 of a semester-credit-hour) toward the requirements for graduation under the corresponding semester-based program. Additional advising support will be provided for CSE graduate students to

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assist in planning course schedules for the last year of quarters (2011-2012) and for the first year of semesters (2012-2013). If it is determined that the “normal” conditions covered by the CSE transition policy would result in a particular student facing an unavoidable delay in graduation compared to quarters due to the change to semesters—rather than the student’s failure to meet with an advisor to complete a proposed plan of study or to make satisfactory progress through the mutually agreed program plan—then a revision of specific requirements will be worked out for that student by their faculty advisor, with approval by the CSE Graduate Studies Committee.

— Xiaodong Zhang, CSE Department Chair

The PhD degree conversion policy below has been designed so that a student finishing a requirement in the quarter system will be deemed to have met the corresponding requirement in the semester system. Total cr-hrs taken under quarters will be converted according to the usual 2/3 sem-cr-hr per qtr-cr-hr completed, and any excess or deficit in sem-cr-hrs for the degree after fulfilling the requirements below will be applied to electives. A student in transition will be deemed to have enough sem-cr-hrs to graduate if his/her total sem-cr-hrs are less than 1 sem-cr-hr below the semester requirement for the PhD program. For example, if a PhD student completes the new graduate core requirements (perhaps partly or completely via the transition policy below), the new major and minor requirements (again, perhaps partly or completely via the transition policy below), and has accumulated a total of more than 59 sem-cr-hrs of graduate credit including electives and research credits, then the student will be deemed to have satisfied the requirement for a total of 60 sem-cr-hrs to complete the first stage of PhD study: pre-candidacy. This, combined with the specific policies below, ensures that no student will lose a single qtr-cr-hr in the transition to semesters.

The current requirement for the PhD core is 5 classes totalling 15 qtr-cr-hrs. Under semesters, as seen in Attachment #1, the new graduate core requirement will be 3 classes totalling 9 sem-cr-hrs. Any PhD core class taken in the quarter system will provide 2 sem-cr-hrs toward the PhD degree, and will count as 1 class toward meeting the 3-class graduate core requirement. The graduate core will be deemed to have been completed when the student has finished a graduate core class (in either the quarter or semester system) in algorithms, in either computability and unsolvability or programming languages, and in either computer architecture or operating systems. Any excess or missing graduate core sem-cr-hrs arising from this conversion will be added to electives, giving students maximum flexibility for completing the cr-hr requirements for the PhD degree.

Regarding PhD major and minor areas, classes taken under quarters will be converted directly as 2/3 sem-cr-hr per qtr-cr-hr, and these will apply to the new sem-cr-hr requirements for major and minor, which are also direct cr-hr conversions.

There are no graduate course sequences in which a student might be caught part-way during the switch to semesters, so there is no need for bridge courses in the CSE graduate programs.

14. Assessment Practices

Not required at this time for graduate programs.

15. Assessment Plan on File with OAA

Not required at this time for graduate programs.

Attachment #1: PhD CSE Proposed Program Requirements

Graduate Core	Course Number	Cr-hrs
Algorithms	CSE 6332	3
Computability and Complexity <i>or</i> Programming Languages	CSE 6322 or 6342	3
Computer Architecture <i>or</i> Operating Systems	CSE 6422 or 6432	3
Total Graduate Core cr-hrs (= 9)		9

PhD Major (note 1)	Course Number	Cr-hrs	Graded cr-hrs
Total PhD Major cr-hrs (≥ 10); graded (≥ 10)			

PhD Minor #1 (note 2)	Course Number	Cr-hrs	Graded cr-hrs
Total PhD Minor #1 cr-hrs (≥ 6 , graded ≥ 5)			

PhD Minor #2 (note 2)	Course Number	Cr-hrs	Graded cr-hrs
Total PhD Minor #2 cr-hrs (≥ 6 , graded ≥ 5)			

PhD Electives (note 3) and Research (note 4)	Course Number	Cr-hrs	Pre or Post?
Total PhD Electives and Research cr-hrs			

PhD Pre-Candidacy cr-hrs (≥ 60)	
PhD Post-Candidacy cr-hrs	
Complete PhD Program cr-hrs (≥ 80)	

Notes:

- (1) See PhD program description for PhD major requirements
- (2) See PhD program description for PhD minor requirements
- (3) Any CSE course at 5000-level or above, except pre-core; or other GSC-approved graduate course
- (4) See PhD program description for PhD dissertation research and dissertation requirements

** Last Updated: June 2006

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■ DOCTOR OF PHILOSOPHY PROGRAM

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■ FOREWORD

This brochure, together with the Graduate School Handbook, contains a complete description of requirements and procedures for the Ph.D. degree in Computer Science and Engineering (CSE). These requirements and the procedures for obtaining the degree are determined in part by the Graduate School, and in part by the Department. Petitions for exception to these requirements should be channeled through the departmental Graduate Studies Committee.

The material in this brochure is oriented primarily for students pursuing the Ph.D. program. Such students must be regular students, admitted to the CSE Department, and conform to Graduate School regulations; special students and students enrolled in Continuing Education must first remove any restrictions. Removal of restrictions is regulated by the Graduate School and the Departmental Graduate Studies Committee.

These procedures and requirements are subject to revision. Applicants should consult material periodically issued by the Graduate School and the Department, their advisor, or the Chair of the Graduate Studies Committee for any changes or interpretation of policy. The Graduate School also maintains a counseling office for students enrolled in Ph.D. Programs.

■ PROGRAM FOR THE DOCTOR OF PHILOSOPHY DEGREE IN CSE

The Doctoral degree is awarded for superior academic and research performance. Consequently, only students who have demonstrated outstanding scholastic ability and research potential will be admitted to the academic and research program leading to the Doctorate. The program of study for the Ph. D. is to be developed by the student in close consultation with his/her academic advisor. Students are encouraged to work out their plan of study as soon as possible so that all requirements may be met.

■ 1 ADVISORS

Each student entering the graduate program in Computer Science and Engineering is initially assigned a tentative academic advisor. Students' degree programs and all courses taken by students must be approved by their academic advisors. Students should consult their advisors as soon as possible after arriving on campus, and periodically thereafter until, upon developing a specific specialty interest, the student chooses a permanent advisor in that specialty area. This choice should be made as soon as practical.

The assignment of students to research advisors is performed by mutual agreement of the student and faculty member. The intent of this explicit agreement is to make students aware of the importance of early interactions with faculty in topic areas of mutual interest. Students are free to change their advisors when mutual research interests change. A "Change of Advisor" form is available in the CSE Office.

The Graduate School rules require that advisors for students in the Ph.D. program be Category P Graduate Faculty members, but it is permissible to have a Category M Graduate Faculty member as a co-advisor. The co-advisor may be the functioning advisor. In such cases, a Category P person should be included as an integral member of the research team early in the student's research, so there is a meaningful collaboration involving the Category M functioning advisor and the Category P advisor. The Graduate School requires that the Category P advisor sign the examination and thesis approval forms.

■ 2 STAGES OF STUDY

The requirements for a Doctoral degree in Computer Science and Engineering are determined in part by general Graduate School requirements for a Ph.D. degree, and in part by specific requirements stipulated by the department. The student should refer to the Graduate School Handbook for residency requirements, regulations concerning transfer of credit from other institutions, and for credit-hour requirements stipulated by the Graduate School.

2.1 Preliminary Requirement:

Prior to entering the first stage of study toward the Doctoral degree, a student has to successfully complete the Ph.D qualifying examination (see Section 3).

2.2 First Stage:

During the first stage of Ph.D. study, the student is required to undertake a program of study in a major area and two minor areas, and to formulate a dissertation proposal. Fifteen credits of coursework in the major area and nine credits in each of the minor areas are required. This coursework cannot include core or pre-core classes, and these credits also need to be from graded graduate classes, with the exception of a total of 3 credits of 793/888 across the two minor areas. The student's research advisor serves as the advisor for the program of study in the major area. The student, in consultation with the research advisor, chooses the two minor areas of study and the minor area advisors. The courses comprising the program of study for the minor areas must be approved by the minor area advisors.

The first stage of study toward a Doctoral degree is completed when the student has received credit for a total of 90 quarter hours of graduate work in a program prescribed by the student's advisor and has passed the Candidacy Examination (see Section 5) to be formally admitted to candidacy. At least six months prior to taking the Candidacy Examination, a proposed schedule of study should be submitted to the Chair of the Graduate Studies Committee for consideration.

2.3 Second Stage:

The second stage is devoted primarily to research and seminars, the preparation of the dissertation, and the Final Examination (see Section 6). The Final Examination is oral and deals intensively with the portion of the candidate's field of specialization in which the dissertation falls, though it need not be confined exclusively to the subject matter of the dissertation.

■ 3 THE QUALIFYING EXAMINATION

The Qualifying Examination is administered Autumn and Spring quarters. Satisfactory performance on this examination, or qualification through the acceleration option listed below, is necessary for admission to the first stage of study towards the Doctoral degree.

The Qualifying Examination is based on the material covered in the graduate core areas, namely, analysis of algorithms, computability and unsolvability, programming languages, operating systems, and computer architecture. Students who have previously studied this material are not required to take the corresponding core courses(s) in the CSE Department; they need only demonstrate their competence in these areas by

satisfactory performance on the Qualifying Examination.

At the time students take the examination, they must have been admitted to the CSE Department and not be on probation. A student whose enrollment eligibility has been deactivated by the Graduate School may, if subsequently reactivated, be required to re-take the Qualifying Examination.

A student who fails the qualifying examination for the first time must retake the examination the next quarter that it is offered. Students must petition the Graduate Studies Committee to retake the examination in any other quarter or to retake the examination more than once.

Acceleration Option for Qualifying Exams: Students who have completed the 5 core classes in their first 3 academic-year quarters with a GPA of 3.6 or better will be automatically granted a 'conditional pass' in the qualifying examination. These students will need to demonstrate substantial research progress during their second year spring evaluation to remove the condition. One clear mechanism for demonstrating such progress is to have an accepted or submitted paper as a significant contributor, working on a project with their advisor.

■ 4 THE CANDIDACY EXAMINATION

This section further specifies the procedure set forth for the Candidacy Examination in Section I of the Graduate School Handbook. That section must be read in conjunction with this document for a full understanding of the rules governing the Candidacy Examination. The Candidacy Examination is a very important means by which the faculty can ensure that the prospective student has the necessary breadth and depth in chosen areas within computer and information science and cognate areas. The student is expected to demonstrate superior knowledge in his or her chosen areas.

To be eligible for the Candidacy Examination, the student is required to select one major area and two minor areas. The student may choose any of the pre-defined major or minor areas specified in the "Guidelines for the Ph.D. Candidacy Exam Major/Minor Areas". To demonstrate mastery in the two minor areas, the student is required to obtain a GPA of 3.3 or higher in the letter-graded courses taken in each of two minor areas. To demonstrate mastery in the major area, the student is expected to prepare a dissertation proposal. The student and the student's major advisor may suggest two examiners who are competent in the student's major area. In the Candidacy Examination, the student will be examined in written and oral format over the major area and the dissertation proposal.

4.1 Proposed Schedule of Study

The student is required to submit to the Graduate Studies Committee a proposed schedule of study for the candidacy examination at least six months in advance of the examination. The schedule should include the choice of major and minor areas, counter-signed by the student's major and two minor advisors, and the student's preliminary dissertation proposal, counter-signed by the student's major advisor and two other faculty members who will serve on the Candidacy Examination Committee. The schedule must also indicate those courses and individual studies already accomplished in each of the major and minor areas, together with additional work planned at this time. The Graduate School must be notified before the written portion of the Candidacy Examination begins.

4.2 Declaration of Intent to Take the Candidacy Examination

After the student's proposed schedule of study has been approved by the Graduate Studies Committee, the Candidacy Examination should be scheduled in consultation with the examination committee. At least one month prior to the scheduled oral examination date, the student should declare formally the intent to take the oral portion of the Candidacy Examination. This Declaration of Intent form must be signed by the student's major advisor and the Chair of the Graduate Studies Committee before transmittal to the Dean of the Graduate School for approval, and for appointment of the Graduate School Representative to the Examination Committee.

4.3 The Candidacy Examination Committee

The Examination Committee consists of the Advisory Committee and a graduate school representative appointed by the Graduate School. The Advisory Committee consists of at least four faculty members, including the student's major advisor, two other members of the Graduate Faculty approved by the Graduate Studies Committee for this function, and a departmental representative appointed by the Graduate Studies Committee.

4.4 Examination Format

The Candidacy Examination consists of two parts, namely, a written examination and an oral examination. The precise times and places of the administration of the Examination will be determined by the Examination Committee, but the entire Examination must be administered within a three-month period.

4.4.1 Written Examination:

The written portion is administered and evaluated by the student's Advisory Committee. It is conducted in the following steps.

a. The student prepares a written dissertation proposal. The proposal should be concise and precise, and should include the following:

- Title and abstract
- Significance of the problem
- Scope and objectives of the research
- Methodology
- Expected results and conclusions
- Expected contributions to the state of art/literature

Students are encouraged to include in the written portion any preliminary results that support the dissertation proposal. The dissertation proposal must be submitted to all members of the Advisory Committee.

b. On receiving the dissertation proposal, the major advisor compiles a written examination for the student, taking into consideration questions posed by and comments received from the rest of the Advisory Committee.

The written examination consists of two parts. The first part asks questions related to the submitted dissertation proposal. The purpose of this part is to examine whether the dissertation proposal has substantial depth to lead to quality research and whether the student is well prepared to conduct the research outlined in the proposal. The student may be asked to revise the proposal in accordance with the suggestions received. The second part examines the student on his overall breadth and depth in his major area.

c. On receiving the written examination, the student submits written answers to the questions (and possibly a revised dissertation proposal, if so requested) to all members of the Advisory Committee.

d. The Advisory Committee evaluates the written portion including the dissertation proposal. If, based on the written portion, the Advisory Committee members see no possibility for a satisfactory overall performance on the Candidacy Examination, the Advisory Committee records an "unsatisfactory" on the Candidacy Examination report form and returns it to the Graduate School.

4.4.2 Oral Examination:

The oral candidacy examination shall last approximately two hours. In addition, a 30-45 minute presentation on the proposed research must be made prior to the oral examination, but after the candidate has made their written proposal available to the committee. As per Graduate School rules, the two hour oral examination is strictly an examination and may not include a formal oral presentation of the dissertation proposal. During this oral examination, the student should be prepared to defend his or her dissertation proposal and to answer questions on a range of topics including the area of specialization and general fundamentals of computer science. Examinees may use prepared slides in answering questions about their proposal. A passing grade requires a unanimous vote of the examination committee.

Notice of the time and place of both the oral portion of the Candidacy Examination and the presentation prior to that will be given to all faculty of the Department.

4.5 Reporting of Results

The student is considered to have passed the Candidacy Examination only when the decision of the Examination Committee is unanimous. The student's performance is evaluated and reported to the Graduate School as "satisfactory" (implying admission to candidacy) or "unsatisfactory" (implying failure and denial of admission to candidacy). When a failure is reported, the student may be permitted to take a second examination if recommended by the Candidacy Examination Committee. No student will be permitted to take the Candidacy Examination more than twice. The advisor is also reminded that a copy of the report to the Graduate School must be sent to the Chair of the Graduate Studies Committee for the Departmental record and student file.

■ 5 READING COMMITTEE AND FINAL EXAMINATION FOR DISSERTATION

After a student has passed the Candidacy Examination, the advisor of the student will nominate a Dissertation Committee to consider the merit of the dissertation. The members of the Dissertation Committee should be kept informed of the progress of research, thus giving them opportunities to make constructive suggestions for improvement of the dissertation.

The Dissertation Committee will consist of the advisor and two other members of the Graduate Faculty approved by the Graduate Studies Committee for this function. Normally, the Dissertation Committee must be approved no later than two quarters in advance of the anticipated graduation date. It is suggested that the Dissertation Committee be chosen from the committee which administered the Candidacy Examination.

The Graduate School should be consulted on the various deadlines for submission of the dissertation as well as for regulations governing the mechanics of its preparation. The Graduate School is to be informed of the Dissertation Committee members and the subject of the dissertation in the quarter of expected graduation.

The Final Oral Examination is held after the approval of the draft of the dissertation by the Dissertation Committee. Generally, the Dissertation Committee and a Graduate School representative will constitute the Final Oral Examination Committee. The examination will be oral and will deal intensively with the portion of the candidate's field of specialization, though it need not be confined exclusively to the subject matter of the student's dissertation. A unanimous vote of the Final Oral Examination Committee is required for the student to pass.

It is expected that the dissertation be made available, and an announcement of the examination be made, at least one week in advance of the Final Oral Examination. The examination is open to the general public. Non-committee members should be permitted to ask questions. It is expected that the Chair of the Committee will control the ordering and kind of questions asked to ensure fairness and reasonable progress of the examination and to ensure that members of the Examination Committee have sufficient opportunity to question the candidate.

■ 6 THE DIRECT PH. D. TRACK

Students intending to pursue study towards a Ph.D. may apply directly to the Direct Ph.D. track. In the Direct Ph.D. track, students focus on research and study in selected areas of concentration from the beginning of their graduate studies, thereby facilitating more rapid progress towards the degree.

In addition to the standard requirements of the Ph.D. program, as detailed earlier, Direct Ph.D. students are required to satisfy the following progress requirements:

- Take at least 12 credits each quarter, commencing from the second quarter.
- Complete all the core courses during the first year of study and either qualify through the acceleration option, or appear for the Qualifying Examination by the first quarter of the second year in the program. Students unable to meet this requirement should petition in advance to the graduate studies chair, with support of their advisor.
- Take at least three research credits in the form of independent study (793), research seminars (788/888) or thesis research (999) every quarter, commencing from their second quarter.
- Identify their research advisor and the major/minor areas of study by the end of the Spring quarter of their first year (or their third quarter, if they enter the Direct Ph.D. track in a different quarter). Students may change research advisor or major/minor areas, with the approval of the Graduate Studies Committee.
- Complete at least 3 courses from the major/minor areas and file a tentative plan of coursework in the major/minor areas by the end of the third quarter in the program. The study plan must be endorsed by the research advisor.

Students in the Direct-PhD track can obtain a Masters automatically by passing the Ph.D. Candidacy Examination. A student in the Direct Ph.D. track is not eligible to take the Department's Masters Comprehensive Examination or to apply for a Masters by writing and defending a Masters thesis. However, a student who is unable to make adequate progress in the Direct Ph.D. track after two years in the program may petition the Graduate Studies Committee to transfer to the Research (Thesis) Track of the Masters program.

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These procedures and requirements are subject to revision. Applicants should consult material periodically issued by the Graduate School and the Department, their advisor, or the Chair of the Graduate Studies Committee for any changes or interpretation of policy. The Graduate School also maintains a counseling office for students enrolled in Ph.D. Programs.

PROGRAM FOR THE DOCTOR OF PHILOSOPHY DEGREE IN CSE

The Doctoral degree is awarded for superior academic and research performance. Consequently, only students who have demonstrated outstanding scholastic ability and research potential will be admitted to the academic and research program leading to the Doctorate. The program of study for the Ph.D. is to be developed by the student in close consultation with his/her academic advisor. Students are encouraged to work out their plan of study as soon as possible so that all requirements may be met.

1 ADVISORS

Each student entering the graduate program in Computer Science and Engineering is initially assigned a tentative academic advisor. Students' degree programs and all courses taken by students must be approved by their academic advisors. Students should consult their advisors as soon as possible after arriving on campus, and periodically thereafter until, upon developing a specific specialty interest, the student chooses a permanent advisor in that specialty area. This choice should be made as soon as practical.

The assignment of students to research advisors is performed by mutual agreement of the student and faculty member. The intent of this explicit agreement is to make students aware of the importance of early interactions with faculty in topic areas of mutual interest. Students are free to change their advisors when mutual research interests change. A "Change of Advisor" form is available in the CSE Office.

The Graduate School rules require that advisors for students in the Ph.D. program be Category P Graduate Faculty members, but it is permissible to have a Category M Graduate Faculty member as a co-advisor. The co-advisor may be the functioning advisor. In such cases, a Category P person should be included as an

integral member of the research team early in the student's research, so there is a meaningful collaboration involving the Category M functioning advisor and the Category P advisor. The Graduate School requires that the Category P advisor sign the examination and thesis approval forms.

2 STAGES OF STUDY

The requirements for a Doctoral degree in Computer Science and Engineering are determined in part by general Graduate School requirements for a Ph.D. degree, and in part by specific requirements stipulated by the department. The student should refer to the Graduate School Handbook for residency requirements, regulations concerning transfer of credit from other institutions, and for credit-hour requirements stipulated by the Graduate School.

2.1 Preliminary Requirement:

Prior to entering the first stage of study toward the Doctoral degree, a student has to successfully complete the Ph.D qualifying process (see Section 3).

2.2 First Stage:

During the first stage of Ph.D. study, the student is required to undertake a program of study in a major area and two minor areas, and to formulate a dissertation proposal. At least 10 cr-hrs of coursework in the major area and 6 cr-hrs in each of the minor areas are required. This coursework cannot include graduate core classes that were used for the qualifying process. All of the 10 credits towards the major and at least 5 credits for each minor need to be from graded graduate classes. The student's research advisor serves as the advisor for the program of study in the major area.

The student, in consultation with the research advisor, chooses the two minor areas of study and the minor area advisors. The courses comprising the program of study for the minor areas must be approved by the minor area advisors. Normally, a student's major should be among the five main CS research areas in the department, which are Computer Systems, Artificial Intelligence, Computer Graphics, Networking, and Software Engineering. The two minor areas should be chosen from among the remaining area of CS, or from relevant areas from other departments, subject to grad studies committee approval. The courses that count towards each of the areas include: Computer Systems: x42x, x43x, x44x, x24x, Artificial Intelligence: x52x, x53x, Computer Graphics: x54x, Networking x46x, x47x, and Software Engineering x23x, x34x.

The first stage of study toward a Doctoral degree is completed when the student has received credit for a total of 60 cr-hrs of graduate work in a program prescribed by the student's advisor and has passed the Candidacy Examination (see Section 5) to be formally admitted to candidacy. At least three months prior to taking the Candidacy Examination, a proposed schedule of study should be submitted to the Chair of the Graduate Studies Committee for consideration.

2.3 Second Stage:

The second stage is devoted primarily to research and seminars, the preparation of the dissertation, and the Final Examination (see Section 6). The Final Examination is oral and deals intensively with the portion of the candidate's field of specialization in which the dissertation falls, though it need not be confined exclusively to the subject matter of the dissertation.

3 THE QUALIFYING PROCESS

The Qualifying Examination is administered Autumn and Spring semesters. Satisfactory performance on this examination, or qualification through the acceleration option listed below, is necessary for admission to the first stage of study towards the Doctoral degree.

The Qualifying Examination is based on the material covered in the graduate core areas. Specifically, students need to take the exam in algorithms, either computability and unsolvability or programming languages, and either operating systems or computer architecture. Students who have previously studied this

material are not required to take the corresponding core courses(s) in the CSE Department; they need only demonstrate their competence in these areas by satisfactory performance on the Qualifying Examination.

At the time students take the examination, they must have been admitted to the CSE Department and not be on probation. A student whose enrollment eligibility has been deactivated by the Graduate School may, if subsequently reactivated, be required to re-take the Qualifying Examination.

A student who fails the qualifying examination for the first time must retake the examination the next semester that it is offered. Students must petition the Graduate Studies Committee to retake the examination in any other semester or to retake the examination more than once.

Acceleration Option for Qualifying Exams: Students who complete the three graduate core classes (algorithms, either computability and unsolvability or programming languages, and either operating systems or computer architecture) in their first two semesters with a GPA of 3.6 or better will be automatically granted a "conditional pass" in the qualifying examination. These students will need to demonstrate substantial research progress during their second year spring evaluation to remove the condition. One clear mechanism for demonstrating such progress is to have an accepted or submitted paper as a significant contributor, working on a project with their advisor.

4 THE CANDIDACY EXAMINATION

This section further specifies the procedure set forth for the Candidacy Examination in the Graduate School Handbook. That section must be read in conjunction with this document for a full understanding of the rules governing the Candidacy Examination. The Candidacy Examination is a very important means by which the faculty can ensure that the prospective student has the necessary breadth and depth in chosen areas within computer and information science and cognate areas. The student is expected to demonstrate superior knowledge in his or her chosen areas.

To be eligible for the Candidacy Examination, the student is required to select one major area and two minor areas. The student may choose any of the pre-defined major or minor areas specified in the "Guidelines for the Ph.D. Candidacy Exam Major/Minor Areas". To demonstrate mastery in the two minor areas, the student is required to obtain a GPA of 3.3 or higher in the letter-graded courses taken in each of two minor areas. To demonstrate mastery in the major area, the student is expected to prepare a dissertation proposal. The student and the student's major advisor may suggest two examiners who are competent in the student's major area. In the Candidacy Examination, the student will be examined in written and oral format over the major area and the dissertation proposal.

4.1 Proposed Schedule of Study

The student is required to submit to the Graduate Studies Committee a proposed schedule of study for the candidacy examination at least three months in advance of the examination. The schedule should include the choice of major and minor areas, counter-signed by the student's major and two minor advisors, and the student's preliminary dissertation proposal, counter-signed by the student's major advisor and two other faculty members who will serve on the Candidacy Examination Committee. The schedule must also indicate those courses and individual studies already accomplished in each of the major and minor areas, together with additional work planned at this time. The Graduate School must be notified before the written portion of the Candidacy Examination begins.

4.2 Declaration of Intent to Take the Candidacy Examination

After the student's proposed schedule of study has been approved by the Graduate Studies Committee, the Candidacy Examination should be scheduled in consultation with the examination committee. At least 2 weeks prior to the scheduled oral examination date, the student should declare formally the intent to take the oral portion of the Candidacy Examination. This Declaration of Intent form must be signed by the student's major advisor and the Chair of the Graduate Studies Committee before transmittal to the Dean of the Graduate School for approval.

4.3 The Candidacy Examination Committee

The Examination Committee consists of at least four faculty members, including the student's major advisor, two other members of the Graduate Faculty approved by the Graduate Studies Committee for this function, and a departmental representative appointed by the Graduate Studies Committee.

4.4 Examination Format

The Candidacy Examination consists of two parts, namely, a written examination and an oral examination. The precise times and places of the administration of the Examination will be determined by the Examination Committee, but the entire Examination must be administered within a three-month period.

4.4.1 Written Examination:

The written portion is administered and evaluated by the student's Advisory Committee. It is conducted in the following steps.

a. The student prepares a written dissertation proposal. The proposal should be concise and precise, and should include the following:

- Title and abstract
- Significance of the problem
- Scope and objectives of the research
- Methodology
- Expected results and conclusions
- Expected contributions to the state of art/literature

Students are encouraged to include in the written portion any preliminary results that support the dissertation proposal. The dissertation proposal must be submitted to all members of the Advisory Committee.

b. On receiving the dissertation proposal, the major advisor compiles a written examination for the student, taking into consideration questions posed by and comments received from the rest of the Advisory Committee.

The written examination consists of two parts. The first part asks questions related to the submitted dissertation proposal. The purpose of this part is to examine whether the dissertation proposal has substantial depth to lead to quality research and whether the student is well prepared to conduct the research outlined in the proposal. The student may be asked to revise the proposal in accordance with the suggestions received. The second part examines the student on his overall breadth and depth in his major area.

c. On receiving the written examination, the student submits written answers to the questions (and possibly a revised dissertation proposal, if so requested) to all members of the Advisory Committee.

d. The Advisory Committee evaluates the written portion including the dissertation proposal. If, based on the written portion, the Advisory Committee members see no possibility for a satisfactory overall performance on the Candidacy Examination, the Advisory Committee records an "unsatisfactory" on the Candidacy Examination report form and returns it to the Graduate School.

4.4.2 Oral Examination:

The oral candidacy examination shall last approximately two hours. In addition, a 30-45 minute presentation on the proposed research must be made prior to the oral examination, but after the candidate has made their written proposal available to the committee. As per Graduate School

rules, the two hour oral examination is strictly an examination and may not include a formal oral presentation of the dissertation proposal. During this oral examination, the student should be prepared to defend his or her dissertation proposal and to answer questions on a range of topics including the area of specialization and general fundamentals of computer science. Examinees may use prepared slides in answering questions about their proposal. A passing grade requires a unanimous vote of the examination committee.

Notice of the time and place of both the oral portion of the Candidacy Examination and the presentation prior to that will be given to all faculty of the Department.

4.5 Reporting of Results

The student is considered to have passed the Candidacy Examination only when the decision of the Examination Committee is unanimous. The student's performance is evaluated and reported to the Graduate School as "satisfactory" (implying admission to candidacy) or "unsatisfactory" (implying failure and denial of admission to candidacy). When a failure is reported, the student may be permitted to take a second examination if recommended by the Candidacy Examination Committee. No student will be permitted to take the Candidacy Examination more than twice. The advisor is also reminded that a copy of the report to the Graduate School must be sent to the Chair of the Graduate Studies Committee for the Departmental record and student file.

5 READING COMMITTEE AND FINAL EXAMINATION FOR DISSERTATION

After a student has passed the Candidacy Examination, the advisor of the student will nominate a Dissertation Committee to consider the merit of the dissertation. The members of the Dissertation Committee should be kept informed of the progress of research, thus giving them opportunities to make constructive suggestions for improvement of the dissertation.

The Dissertation Committee will consist of the advisor and two other members of the Graduate Faculty approved by the Graduate Studies Committee for this function. Normally, the Dissertation Committee must be approved no later than in one semester in advance of the anticipated graduation date. It is suggested that the Dissertation Committee be chosen from the committee which administered the Candidacy Examination.

The Graduate School should be consulted on the various deadlines for submission of the dissertation as well as for regulations governing the mechanics of its preparation. The Graduate School is to be informed of the Dissertation Committee members and the subject of the dissertation in the semester of expected graduation.

The Final Oral Examination is held after the approval of the draft of the dissertation by the Dissertation Committee. Generally, the Dissertation Committee and a Graduate School representative will constitute the Final Oral Examination Committee. The examination will be oral and will deal intensively with the portion of the candidate's field of specialization, though it need not be confined exclusively to the subject matter of the student's dissertation. A unanimous vote of the Final Oral Examination Committee is required for the student to pass.

It is expected that the dissertation be made available, and an announcement of the examination be made, at least one week in advance of the Final Oral Examination. The examination is open to the general public. Non-committee members should be permitted to ask questions. It is expected that the Chair of the Committee will control the ordering and kind of questions asked to ensure fairness and reasonable progress of the examination and to ensure that members of the Examination Committee have sufficient opportunity to question the candidate.

6 THE DIRECT PH. D. TRACK

Students intending to pursue study towards a Ph.D. may apply directly to the Direct Ph.D. track. In the Direct Ph.D. track, students focus on research and study in selected areas of concentration from the beginning of their graduate studies, thereby facilitating more rapid progress towards the degree.

In addition to the standard requirements of the Ph.D. program, as detailed earlier, Direct Ph.D. students are required to satisfy the following progress requirements:

- Take at least 12 cr-hrs each semester, commencing from the second semester.
- Complete all the core courses during the first year of study and either qualify through the acceleration option, or appear for the Qualifying Examination by the first semester of the second year in the program. Students unable to meet this requirement should petition in advance to the graduate studies chair, with support of their advisor.
- Take at least 3 research cr-hrs in the form of independent study, research seminars ("Advanced Topics in ..."), or thesis research every semester, commencing from their second semester.
- Identify their research advisor and the major/minor areas of study by the end of the Spring semester of their first year (or their second semester, if they enter the Direct Ph.D. track in a different term). Students may change research advisor or major/minor areas, with the approval of the Graduate Studies Committee.

Students in the Direct Ph.D. track can obtain a Masters automatically by passing the Ph.D. Candidacy Examination. A student in the Direct Ph.D. track is not eligible to take the Department's Masters Comprehensive Examination or to apply for a Masters by writing and defending a Masters thesis. However, a student who is unable to make adequate progress in the Direct Ph.D. track after two years in the program may petition the Graduate Studies Committee to transfer to the Research (Thesis) Track of the Masters program.

Attachment #4
List of all CSE Graduate Courses

CSE 5231	Software Engineering Techniques	3.0
CSE 5232	Software Requirements Analysis	2.0
CSE 5234	Distributed Enterprise Computing	3.0
CSE 5235	Applied Enterprise Service Architectures	3.0
CSE 5236	Mobile Application Development	3.0
CSE 5239	Intermediate Studies in Software Engineering	2.0
CSE 5241	Introduction to Database Systems	2.0
CSE 5242	Advanced Database Management Systems	3.0
CSE 5243	Introduction to Data Mining	3.0
CSE 5245	Introduction to Network Science	3.0
CSE 5249	Intermediate Studies in Databases	2.0
CSE 5321	Automata and Formal Languages	2.0
CSE 5331	Foundations II: Data Structures and Algorithms	2.0
CSE 5339	Intermediate Studies in Algorithms	2.0
CSE 5341	Principles of Programming Languages	2.0
CSE 5343	Compiler Design and Implementation	3.0
CSE 5349	Intermediate Studies in Programming Languages	2.0
CSE 5351	Introduction to Cryptography	3.0
CSE 5359	Intermediate Studies in Cryptography	2.0
CSE 5361	Numerical Methods	3.0
CSE 5421	Introduction to Computer Architecture	2.0
CSE 5429	Intermediate Studies in Computer Architecture	
CSE 5431	Systems II: Introduction to Operating Systems	
CSE 5433	Operating Systems Laboratory	3.0
CSE 5439	Intermediate Studies in Operating Systems	2.0

CSE 5441	Introduction to Parallel Computing	3.0
CSE 5449	Intermediate Studies in Parallel Computing	2.0
CSE 5461	Computer Networking and Internet Technologies	2.0
CSE 5462	Network Programming	3.0
CSE 5463	Introduction to Wireless Networking	3.0
CSE 5469	Intermediate Studies in Computer Networking	2.0
CSE 5471	Information Security	3.0
CSE 5472	Information Security Projects	3.0
CSE 5473	Network Security	3.0
CSE 5479	Intermediate Studies in Computer Security	2.0
CSE 5501	Social, Ethical, and Professional Issues in Computing	1.0
CSE 5521	Survey of Artificial Intelligence I: Basic Techniques	3.0
CSE 5522	Survey of Artificial Intelligence II: Advanced Techniques	3.0
CSE 5523	Machine Learning and Statistical Pattern Recognition	3.0
CSE 5524	Computer Vision for Human-Computer Interaction	3.0
CSE 5525	Foundations of Speech and Language Processing	3.0
CSE 5526	Introduction to Neural Networks	3.0
CSE 5531	Introduction to Cognitive Science	3.0
CSE 5532	Proseminar in Cognitive Science	2.0
CSE 5539	Intermediate Studies in Artificial Intelligence	
CSE 5541	Computer Game and Animation Techniques	2.0
CSE 5542	Real-Time Rendering	3.0
CSE 5543	Geometric Modeling	3.0
CSE 5544	Introduction to Scientific Visualization	3.0
CSE 5545	Advanced Computer Graphics	3.0
CSE 5559	Intermediate Studies in Computer Graphics	2.0

CSE 5911	Capstone Design: Software Applications	4.0
CSE 5912	Capstone Design: Game Design and Development	4.0
CSE 5913	Capstone Design: Computer Animation	4.0
CSE 5914	Capstone Design: Knowledge-Based Systems	4.0
CSE 5915	Capstone Design: Information Systems	4.0
CSE 6193	Individual Studies in Computer Science and Engineering	
	1.0 - 10.0	
CSE 6194	Group Studies in Computer Science and Engineering	1.0
	- 10.0	
CSE 6231	Formal Foundations of Software Engineering	3.0
CSE 6239	Advanced Studies in Software Engineering	1.0 - 3.0
CSE 6249	Advanced Studies in Databases	1.0 - 3.0
CSE 6321	Computability and Complexity	3.0
CSE 6329	Advanced Studies in Computation Theory	1.0 - 3.0
CSE 6331	Algorithms	3.0
CSE 6332	Advanced Algorithms	3.0
CSE 6333	Distributed Algorithms	3.0
CSE 6339	Advanced Studies in Algorithms	1.0 - 3.0
CSE 6341	Foundations of Programming Languages	3.0
CSE 6349	Advanced Studies in Programming Languages	1.0 - 3.0
CSE 6359	Advanced Studies in Cryptography	1.0 - 3.0
CSE 6421	Computer Architecture	3.0
CSE 6422	Advanced Computer Architecture	3.0
CSE 6429	Advanced Studies in Computer Architecture	1.0 - 3.0
CSE 6431	Advanced Operating Systems	3.0
CSE 6439	Advanced Studies in Operating Systems	1.0 - 3.0
CSE 6441	Parallel Computing	3.0
CSE 6449	Advanced Studies in Parallel Computing	1.0 - 3.0
CSE 6461	Computer Communication Networks	3.0

CSE 6469	Advanced Studies in Computer Networking	1.0 - 3.0
CSE 6479	Advanced Studies in Computer Security	1.0 - 3.0
CSE 6539	Advanced Studies in Artificial Intelligence	1.0 - 3.0
CSE 6559	Advanced Studies in Computer Graphics	1.0 - 3.0