From:	Smith, Randy
Sent:	Wednesday, December 09, 2015 11:34 AM
To:	Soundarajan, Neelam; McCaul, Edward
Cc:	Smith, Randy; Reed, Katie; Lilly, Blaine; Tomasko, David; Myers, Brad; Carlson, Wayne; Wanzer, John
Subject:	Computer Science Engineering

Neelam and Ed:

The proposal from the College of Engineering to revise the Bachelor of Science in Computer Science and Engineering degree program was approved by the Council on Academic Affairs at its meeting on December 2, 2015. Thank you for attending the meeting to respond to questions/comments.

No additional level of review/approval is necessary. This action will be included in the Council's next Annual Activities Report to the University Senate (June 2016).

Please keep a copy of this message for your file on the proposal and I will do the same for the file in the Office of Academic Affairs.

If you have any questions, please contact the Chair of the Council, Professor Blaine Lilly (.2) or me.

Randy

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Friday, November 20, 2015

Randy Smith
Vice Provost for Academic Affairs
Committee on Academic Affairs

Blaine Lilly
Chair
Committee on Academic Affairs
Dear Randy and Blaine,

  Subcommittee C has had under consideration the proposal to revise the CSE UG program. The subcommittee has raised no substantial concerns, so I would recommend that we place this proposal in the queue for approval by the full committee.

  Sincerely,

John A. Buford, PT, PhD
Chair, Subcommittee C

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Date: 6 October 2015

To: Randy Smith
Vice Provost, Office of Academic Affairs (OAA)

From: Ed McDaul
Secretary, College Committee on Academic Affairs (CCAA)

Subject: Proposal to revise the Computer Science and Engineering
undergraduate program curriculum

CCAA has reviewed and approved the attached proposal to revise the

undergraduate curriculum of our Computer Science and Engineering program on

the 1st of October 2015. I am forwarding the proposal to you so that it can be

approved by the Council on Academic Affairs. If you have any questions

concerning this proposal please let me know.

Proposed Changes in the BS-CSE Program

1. Background

Under the quarter system, students in the BS-CSE program were required to choose a *technical elective* (TE) option from a specified set, including *software systems*, *information and computation assurance*, etc. Students choosing a given option had to include, among their technical elective courses, a specified set of courses; each option also listed a number of recommended courses that students might choose from for the remaining tech elective hours. In order to meet the needs of students who may have interests that did not fit into any of the specified options, there was an *individualized* option; students in this option were expected to consult with their faculty advisor to come up with an appropriate set of courses for their tech electives, matching their interests.

This approach had two advantages. First, a student interested in a given area, such as software systems, had clear guidance on what courses were most relevant for that area, these being the courses required for the particular TE option. Second, upon graduation, the student's transcript contained a designation, such as *SoftSys*, denoting the TE option that the student completed. And this designation was of value, for example, to potential employers when considering the student for particular employment opportunities.

When we moved to the semester system, it was not clear, for various reasons, how to translate the TE options to the semester system; e.g., the structure of the required ("core") courses was different; the total number of courses a student could take was fewer; and the courses, while they were directly based on corresponding courses under quarters, were themselves new. Hence the idea of TE options was not included when we transitioned to semesters.

2. Summary of changes

1. Now that we have had nearly three years of experience with the semester system and the courses have stabilized, and given the advantages noted above of the TE options, the CSE faculty propose to reintroduce TE options. The TE options being proposed are based on the ones under the quarter system, including the Individualized Option.

One point to note is that any set of courses that meets all the requirements of any of the proposed TE options once this change is in place also meets the current requirements of the BS-CSE program. Moreover, any set of courses that meets the current requirements will also, given the *individualized option*, meet the requirements of the revised program; at the same time, it should be stressed that the *primary* purpose of this option is to provide flexibility to students to tailor, in consultation with their advisor, a suitable set of courses based on their specific interests, rather than to ensure that the current program requirements match the revised requirements.

Thus the main reasons for proposing the change are the two advantages noted above: that students interested in a given area will have clear guidance on which courses to take; and the students' transcripts will contain a designation indicating the area they focused on in their technical elective courses.

2. A second change, unrelated to the TE options, has to do with ECE 2000 and 2100 (4 cr hrs each), the two ECE courses that BS-CSE majors are required to take. Based on feedback from BS-CSE majors and from ECE majors, the ECE Dept. has proposed replacing these with a set of new courses. For the BS-CSE majors, this would mean replacing the 8 credit hours of ECE 2000, 2100 with 6 credit hours of ECE 2020 and 2060 (3 cr hrs each) and adding 2 cr hrs to the technical electives hours which will increase from 15 cr hrs to 17 cr hrs. This change has been described as part of the proposal from the ECE Dept. but, since that proposal is still going through the system, for the sake of completeness, it is mentioned here.

3. A third and final change, also unrelated to the TE options, has to do with the *engineering ethics* course requirement that all Engineering majors are required to meet and *CSE 2501* that BS-CSE majors are currently required to take. One of the courses approved as an *engineering ethics* course is *Phil 1137, Computing Ethics*, and many BS-CSE majors take that course. CSE 2501 is 1-cr hr course that was introduced many years ago (under the quarter system, it was CSE 601) and it has two goals: first, to introduce students to key ideas related to ethical and professional issues in computing; and, second, to enable them improve their oral and written communication skills. Both of these are related to key program outcomes for our program and hence the course is required of all BS-CSE majors.

But with the creation of Phil 1337 a few years ago, students who took that course to meet the engineering ethics requirement found, not surprisingly, that there was considerable overlap betwen the material in the two courses. A number of students, including the student reps on our Undergraduate Studies Committee, raised this issue; the coordinator for the course also expressed concerns about this. Discussions in our Curriculum and Undergraduate Studies committees suggested two possible ways to address this. The first would be to require all BS-CSE majors to take Phil 1337 and then take CSE 2501, with the latter being revised to take account of the additional background that students would acquire in 1337; the second would be to request the Philosophy Dept. to create a new course, now numered Phil 1338, similar in material to Phil 1337 but also including development of oral and written communication skills of students as key learning objectives as well as discussion of such items as the *ACM Code of Conduct* which is generally considered as guidelines for computing professionals.

The Philosophy Dept. was keen on following this second alternative with the caveat that Phil 1338 would have to be *4* credit hours rather than 3, as is Phil 1337. This seemed reasonable given the additional learning objectives; our committees also decided that, assuming that Phil 1338 is approved as a GE course and is approved as meeting the engineering ethics requirement, any student who completes it would not have to take CSE 2501.

In summary, any BS-CSE major who takes Phil 1338 would not take CSE 2501; a student who takes one of the other approved engineering ethics courses would be required to take CSE 2501; students would be advised not to take Phil 1337 to meet the engineering ethics requirement because then they would have to take CSE 2501 and will find the material duplicative. This change would be neutral with respect to credit hours.

3. Process

The idea of re-introducing technical elective (TE) options was discussed extensively at a number of Undergraduate Studies Committee meetings in Autumn 2014. Toward the end of the fall semester, the CSE faculty as a whole discussed the idea as well as the specific courses to be included in the various options electronically. The idea was strongly endorsed by students, advisors, and faculty. The proposed change was presented at the departmental Annual Undergraduate Forum on March 24. The students at the forum were strongly in favor of the idea. The faculty approved the proposal unanimously via an electronic vote. Following some procedural considerations, the proposal was discussed at a CSE faculty meeting on Sept. 17, 2015, and approved unanimously.

The problems with the ECE 2000, 2100 courses had been discussed previously, including at the Annual Forum of March 2014 and the ECE faculty had been informed of the issues. Over Summer and Fall '14, the ECE faculty involved us in discussions of how the courses might be modified to meet the concerns of BS-CSE majors (as well as concerns expressed by ECE majors). Based on those discussions, the ECE faculty came up with a proposal to replace ECE 2000, 2100 with a set of three new courses; of these, ECE 2020 and 2060 would be the ones that would meet the needs of BS-CSE majors. The net result would be that BS-CSE majors would be required to take ECE 2020, 2060 (3 cr hrs each) in place of ECE 2000, 2100 (4 cr hrs each) and the 2 cr hrs released by this change would be added to the technical elective hours of the BS-CSE program. CSE faculty approved these changes unanimously and the students are very much in favor of them.

As noted earlier, the problems encountered by students who take Phil 1337 to meet the engineering ethics requirement. i.e., the overlap between the material in that course with that in CSE 2501, was brought up both by students in CSE 2501 which were then conveyed to the Curriculum Committee by the course coordinator for CSE 2501 and by student reps on the Undergrad Studies Committee. The problem was discussed in the committees and following discussions with the Philosophy Dept., the idea of creating a 4-credit Phil 1338 that would not only present material related to ethical and professional issues in computing but also include activities that ensure that students' oral and written communication skills are developed which is the other key outcome of CSE 2501. The proposal that students who take Phil 1338, assuming that it is approved by Engineering's Core Committee to meet the engineering ethics requirement, would then be considered to have met both that requirement as well as the equivalent of CSE 2501, was discussed at the Annual Student Forum on March 24, 2015 and was very well received. It was sent to the CSE faculty by email for their approval and was approved unanimously.

4. Current BS-CSE Curriculum

The BS CSE Curriculum consists of the following components:

1. CSE Core (22 hours):
   - CSE 2221, 2231 (Software I, II; 8 hrs)
   - CSE 2321, 2331 (Foundations I, II; 6 hrs)
   - CSE 2421, 2431 (Systems I, II; 7 hrs)
   - CSE 2501 (Professionalism, ethics; 1 hr)*

2. CSE Core Choices (20 hours including 4 hrs of capstone design):
   - CSE 390X Project (4 hrs)
   - CSE 3231 or 3241 (Software Eng or Databases) (3 hrs)
   - CSE 3321 or 3341 (Formal Langs or Prog. Langs) (3 hrs)
   - CSE 3421 or 3461 (Systems: Architecture/Networking) (3 hrs)
   - CSE 3521 or 3541 (Applications: AI/Graphics) (3 hrs)
   - CSE 591X Capstone (4 hrs)

3. Math, Science, Engineering Core (37 hours):
   - Math 1151, 1172 (Calculus I, II) (10 hrs)
   - Physics 1250 (5 hrs)
   - Engineering 1181, 1182 (4 hrs)
   - Engineering Survey 1100.xx (1 hr)
   - ECE 2000, 2100 (ECE I, II) (8 hrs)*
   - Math 3345 (Fnds of Higher Math) (3 hrs)
   - Math 2568 (Lin Alg.) (3 hrs)
   - Stat 3470 (Prob and Stats) (3 hrs)

4. General Education (24 hours):
   - English, Writing I (Engl 1100.xx), Writing II (6 hrs)
   - Literature (3 hrs)
   - Arts (3 hrs)
   - Historical Study (3 hrs)
   - Culture and Ideas: Ethics (3 hrs)
   - Social Science I, II (6 hrs)

5. Electives (23 hours):
   - Math/Stats Elective (3 hrs)
   - Science Elective (5 hrs)
   - Technical Electives (15 hrs)*:
     - At least 8 hrs must be CSE courses at the 3000-level or above; the remaining may be letter-graded non-CSE courses approved by the advisor;
     - At most 1 cr-hr of CSE 425X;
     - At most 2 cr-hrs total of CSE 4193, 4193H, 4998, 4998H, 4999, 4999H;
     - Students are strongly urged to consider choosing a focus area in deciding their tech elective courses.
     - The Advising Office can suggest focus areas based on interest, and minor programs with 7 cr-hrs counted toward Tech Electives.

The minimum total hours for the BS CSE degree is 126 credit hours.

* The changes detailed on the next page are related to the items marked with an asterisk (*).

5. Proposed Revisions:

1. ECE 2000, 2100 (8 hrs) will be replaced by ECE 2020, 2060 (6 cr hrs) with the 2 hours being added to the Technical Elective hours which will become 17 credit hours.

2. Ethics course requirement: Students who take the 4-credit hour Phil 1338 to meet the engineering ethics requirement (pending approval of the course for this purpose), will not have to take CSE 2501 since that course is designed to also meet the intended outcomes of 2501.

3. Technical Electives (17 hrs): Must meet the following requirements:
   - At least 9 hrs must be CSE courses at the 3000-level or above; the remaining may be letter-graded non-CSE courses approved by the advisor;
   - At most 1 cr-hr of CSE 425X;
   - At most 2 cr-hrs total of CSE 4193, 4193H, 4998, 4998H, 4999, 4999H;
   - The Advising Office can suggest minor programs with 7 hrs counted toward Tech Electives.

   In addition, the courses chosen under the categories *CSE Core Choices* and *Technical Electives* must meet the requirements of one of the following *options*:

   (a) Artificial Intelligence Option:
      - Required courses: CSE 3521, 5522; one of CSE 5523, 5524, 5525, 5526
      - Recommended courses: CSE 5523, 5524, 5525, 5526, 5914

   (b) Computer Graphics and Game Design Option:
      - Required courses: CSE 3902, 3541; one of: CSE 5542, 5543, 5544, 5545, 5912
      - Recommended courses: CSE 5542, 5543, 5544, 5545, 5912

   (c) Database systems and Data analytics Option:
      - Required courses: CSE 3241, 5242; one of CSE 5243, 5523
      - Recommended courses: CSE 5243, 5523

   (d) Information and Computation Assurance Option:
      - Required courses: CSE 3461, 4471; one of CSE 5472, 5473
      - Recommended courses: CSE 3901, 5351, 5432;
           relevant courses in business, econ, law.

   (e) Computer Networking Option:
      - Required courses: CSE 3461; two of: CSE 5432, 5462, 5463, 5472, 5473
      - Recommended courses: CSE 3901, 5351, 5432, 5462, 5463, 5472, 5473

   (f) Computer Systems Option:
      - Required courses: CSE 3421; CSE 5433 or 5441;
           3 *additional* hours from {CSE 5433, 5441, 3461, 5243}
      - Recommended courses: CSE 5433, 5434, 5441, 6421, 6431, 6441

   (g) Software Engineering Option:
      - Required courses: CSE 3231, 3232; one of: CSE 3341, 5234, 5235, 5236
      - Recommended courses: CSE 3341, 5234, 5235, 5236

   (h) Individualized Option:
      - Recommended courses: Students should consult with their faculty advisors to identify the most reasonable set of courses that would be appropriate, given their specific interests.