Proposal to Change the Requirements of the Undergraduate Program in Computer Engineering

Computing has changed dramatically since the undergraduate program in Computer Engineering was created at the University of Maryland. It has become much broader, with many new sub-disciplines--such as Machine Learning and the Internet of Things--that promise to impact society in profound ways. Yet, the Computer Engineering program has not evolved in response to this change. In particular, it imposes a large number of required courses, some of which now exhibit diminished importance within the Computer Engineering discipline as the field has broadened. Moreover, the large number of required courses limits students' flexibility to pursue depth at the 400 level in sub-disciplines that interest them.

In recent years, retention of students within the Computer Engineering program has become a problem. While there may be many reasons for this, the overly rigid nature of the program is a contributing factor. Some students who become frustrated with the large number of requirements switch majors, often to Computer Science since they already have all of the required courses for CS. In this regard, the current Computer Engineering program does not adequately serve the needs of its students, which is unacceptable to the faculty.

We propose to modify the Computer Engineering program to address these deficiencies. Specifically, we will reduce the number of required 300-level courses, making room for students to take a larger number of 400-level courses. We will also organize the 400-level ENEE courses (Category C) into tracks, providing more structure to better help students navigate the hardware-oriented technical electives.

Program Change Details

1. **Modify the requirements for 300-level courses.**
   We propose to reduce the number of requirements and to provide greater flexibility at the 300 level within the Computer Engineering program. Currently, the required 300-level courses include ENEE 303, ENEE 307, ENEE 322, ENEE 324, and ENEE 350. ENEE 350 will remain a required course, but the other requirements will be changed. ENEE 307 will be eliminated as a required course for Computer Engineering majors. Among ENEE 303 and ENEE 322, students will be required to take one, but not both, of these courses. Students will be free to choose either ENEE 303 or ENEE 322 to satisfy this requirement. Probability theory, the topic of ENEE 324, must remain a requirement within the Computer Engineering major as prescribed by ABET. However, students will be allowed to take either ENEE 324 or STAT 400 (Applied Probability and Statistics) to fulfill the probability theory requirement.

2. **Modify the number of technical elective credits.**
   The above change to the 300-level required courses will open up 5 credits. (Eliminating ENEE 307 opens up 2 credits, and only requiring either ENEE 303 or ENEE 307, opens

up 3 credits). This will permit students to pursue a larger number of technical electives. Currently, Computer Engineering majors are required to take 22 credits of technical electives. Under the modified program, this will be increased to 26 credits. (Overall, there will be a savings of 1 credit for the entire major).

3. **Modify the structure of and requirements for Category C.**
   Given the large number of technical elective credits under the modified program, students will choose more elective courses from Category C. To help inform students on this choice, the courses within Category C will be grouped together based on the 300-level course that is the prerequisite to the Category C course. These groupings form "tracks" within Category C. We define the following tracks:
   > Circuits / E&M Track: ENEE 313, ENEE 380, ENEE 411, ENEE 413, ENEE 475, ENEE 476, ENEE 490, ENEE 496, and ENEE 489Q
   > Systems Track: ENEE 425, ENEE 460, ENEE 463, and ENEE 474
   > Communications Track: ENEE 420, ENEE 426, and ENEE 469O.
   > Computing Track: ENEE 440, ENEE 457, ENEE 459P, ENEE 459V, and ENEE 439M

   Currently, Computer Engineering majors are required to take at least 3 credits chosen from any course listed within Category C. Under the modified program, Computer Engineering majors will be required to take at least 6 credits from any course listed within Category C. While students will have freedom to choose any courses, practically speaking, they may be limited by their choice of 300-level courses, as discussed above.

   All students will be able to take any course from the Computing Track. These courses require ENEE 350 which all students are required to take. (ENEE 439M requires ENEE 324 or STAT 400, but all students will take one of these two courses). Only students that take ENEE 324 will be able to take courses from the Communications Track. (STAT 400 cannot substitute ENEE 324 for these courses). And depending on whether students take ENEE 303 or ENEE 322, they may be better prepared to choose courses from the Circuits / E&M Track or the Systems Track, respectively.

4. **Remove ENEE 322 as a prerequisite for ENEE 324.**
   Currently, ENEE 322 is a prerequisite for ENEE 324. Only a very small portion of ENEE 324 requires some of the material from ENEE 322. ENEE 324 will be modified to eliminate this dependence, allowing ENEE 322 to be removed as a prerequisite for ENEE 324. This change is necessary in order to define the Systems and Communications Tracks as separate tracks.

Resource Implications of the Program Change

The proposed changes do not require developing any new courses. They only require the relatively minor modification to ENEE 324 to eliminate any dependences on ENEE 322.

One notable impact is the increase in the number of technical elective courses that students will take. In particular, students will take at least one additional course in Category C. The ECE department is committed to accommodating any changes in demand in the 400-level ECE courses that this program change may have.

Also, because the total elective credits will be increased to 26 credits, there will be 3 unspecified credits for which students can take an additional technical elective from any category. (Under the modified program, students will be required to take 6 credits from Category A, 3 credits from Category B, 6 credits from Category C, 2 credits from Category D, 3 credits from Category E, and 3 credits from Category F, or 23 credits, thus leaving 3 credits to reach the 26-credit total). It is possible that some students may decide to take an additional course from Category B—*i.e.*, a CMSC 400-level course. The Computer Science Department is already experiencing significant pressure on enrollment in their 400-level courses, so this is a concern.

We believe the impact of our program change will be minimal on the CMSC 400-level course enrollments for two reasons. First, under the old program which required 22 credits of technical elective courses, students already had 2 additional unspecified credits. We are only increasing this by 1 credit to 3 unspecified credits. We believe this incremental change will cause only a negligible number of additional students to take another CMSC 400-level course beyond the number who are already doing so currently. Second, there could be an offsetting effect. As mentioned earlier, the current rigidity in the Computer Engineering program may be responsible for attrition in the major, with many of the departing students going to the Computer Science Department. As CS majors, these students take **even more** CMSC courses. (They are required to take 7 CMSC 400-level courses). If our program modifications have the intended effect of improving retention, we anticipate that the **net increase** in CMSC 400-level enrollment can be further mitigated.

Finally, we expect an increase in the enrollment in STAT 400. The Math Department has tentatively expressed support for this proposal, and will plan to accommodate the additional seats, as long as they are given advanced information about the projected enrollments.