Rationale for Various Proposed Placements of Physical Electronics in EE Core

Curricular revisions related to ECE 440 in particular and various options for how we include physical electronics material in our core have occupied considerable Curriculum Committee time and extensive course development effort on the part of several of our colleagues, and will likely continue to do so over the next couple of years. We should thus focus our (and our colleagues') energies on the options likely to gain widespread departmental support. The preferred options will depend substantially on high-level considerations as to the nature of Electrical and Computer Engineering careers in 2008 and beyond.

Below are several proposed options, and my high-level rationale and commentary and those collected from various colleagues regarding each option. The various rationale are not all consistent, but all have some merit; our decisions will likely hinge on weighing the relative merit and relevance integrated across the hundreds of different career paths likely to be pursued by all of our students over the next four decades.

Suggested Options

1. Renumber current ECE 440 with minor modifications as ECE 340 and retain in required core as it is now.
    - Physical electronics underlies all progress in Electrical and Computer Engineering, so all students should be familiar with it.
    - A deep understanding is so essential that all students should "eat their spinach" even if its difficult and painful for many.
    - Current ECE 440 is a uniquely strong "wonder course" that sets all of our students apart from MIT, Stanford, etc. peers.
    - Many students very unhappy.
    - Lots of complaints by parents at College level; College might eventually intervene and force change or overrule requirement.
    - Most students take in senior year; not serving proper role as core course as prerequisite.
    - Discourages or delays students from specializing in physical electronics area.
2. Renumber current ECE 440 with minor modifications as ECE 340 but move it to a "4 of 6" list (move from required to semi-required advance core)
    - While physical electronics underlies EE and remains core, in the billion-transistor-chip and fabless semiconductor era, many EEs will never work at the single device level in their careers; this fraction can bypass this material without significant danger to their ultimate career success.
    - Students who find this material very difficult or uninteresting can opt out, thus allowing the course to be taught at a somewhat higher level.
    - Removing the most unhappy students may considerably improve overall climate and perception of the course.
    - Can remain as a single, good prerequisite to more advanced courses in physical electronics area.
    - Material is quite sophisticated and is inherently "advanced", and needs to be taught as such.
    - Minimal-effort solution for relieving student problems.
    - Students who might like this area may never discover it.
3. Current ECE 440 becomes technical elective (move physical electronics out of core)
    - In the billion-transistor-chip and fabless semiconductor era, relatively few EEs or CompEs will ever work at the single device level in their careers; this has become a specialized topic in

practice.
    - Course can be taught at a high level for those specializing in this area.
    - Other benefits of making 440 optional (above) obtained.
    - Students who might like this area even less likely to discover it.
    - Increases technical electives by three hours.
4. Beef up physical electronics content in ECE 442 (-->342) and make it required, and move ECE 440 (-->340 similar to current 440) to a "3 of 6" advanced core list
    - ECE 442 already contains the essential physical electronics issues needed by circuit designers.
    - Coupling device physics with circuits may be more motivating for the students.
    - Other benefits of making 440 only semi-required (above) obtained.
    - Less device physics for some students than in current curriculum.
5. Develop a new ECE 340 substantially different from current ECE 440 for the required core
    - Could be designed to better serve the vast majority of students who do *not* specialize in physical electronics.
    - Might be taken earlier and thus serve as a useful prerequisite for more courses (e.g., 442).
    - Should increase number of students specializing in physical electronics areas.
    - Could greatly reduce student unhappiness if well done.
    - Would require substantial change of some upper-level physical electronics courses.
6. Develop a new ECE 340 substantially different from current ECE 440 for the required core and move current ECE 440 or similar to the "3 of 6" list
    - Same benefits and drawbacks for many students as noted above.
    - Even stronger program in physical electronics for students who take ECE 440, too.
    - Should substantially increase number of students specializing in physical electronics areas.
    - Allows students to opt out of additional advanced core course.
7. Develop a new ECE 340 substantially different from current ECE 440 for the required core and place it on a "1 of 2" list with current ECE 440 or similar
    - Provides solid physical electronics exposure to every student, while retaining single course prerequisite to advanced courses in area for the specialist.
    - Allows different emphases for different areas.
    - Could greatly reduce student unhappiness if well done.
    - Allows more experimentation, flexibility.

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