



University of Illinois at Urbana-Champaign
Dept. of Electrical and Computer Engineering

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To: Curriculum Committee

From: Kent Choquette
James Coleman
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Re: ECE398KC

This response is written to address the issues that the Microelectronic and Photonic area committee have raised regarding the proposed course, ECE398KC. This course has been developed to serve as an elective junior level introduction to photonics. The field photonics covers the emission, switching, transmission, and detection of light. Several faculty who teach and pursue research in the photonics area are concerned that no suitable introduction course presently exists within the ECE curriculum. Moreover, there are several senior level photonic courses which are actively taught (ECE450, 452, 455, 460, 465/466, 467, 468, and 495), which have an increasing percentage enrollment of graduate students. The required courses ECE329 and 340 cover a small portion of the primary content proposed in ECE398KC, and thus undergraduates are marginally exposed to the field of photonics. Thus, there is an important need for a photonics undergraduate introduction course. ECE398KC has been reviewed by the M&P area committee since Jan. 26, and the final issues raised by the area committee Chair K. Y. Cheng are:

1. Too much overlapping with required core courses:

a. You listed 20% (~8.5 hours) on semiconductor electronic properties and electrical junctions. These topics are heavily covered in ECE440 (or ECE340 next year) with more than 16 hours. ECE440 spends more than 8 hours on p-n junction alone and 3 hours on emission and absorption.

b. On photonic devices, again, ECE440 has more than two hours dedicate to it without counting other 400 level elective courses on this topic.

c. You listed 20% (~8.5 hours) on dielectric optical properties. These topics are covered in ECE329 (lecture 19-21 on wave equation) and ECE450 (lecture 16-19 on reflection, and lecture 22-23 on dispersion).

Overall, there are over 40% of the course materials are covered by other required or 3 out of 5 core courses. Of course it is unavoidable to have some overlap (10-15%) among related courses, but >40% is excessive.

First of all, comparison of ECE398 to a 400 level course is not relevant, since the former seeks to serve as an introduction, not replacement, for an advanced senior level course.

Secondly, the advanced core course, ECE440/340 is an introduction to Si-based microelectronic devices and serves as to prerequisite to ECE441, 442, and 488. As can be seen from the ECE340 syllabus that was reviewed and recommended by the Curriculum Committee, issues related to the transport of electrons, rather than optical emission processes, are the primary focus of 340. For example, syllabus of 340 states that “optical absorption” is one of 9 topics that are discussed over 7 hours; optical emission is omitted. Also note that the 16 hours in 340 which cover semiconductor properties and p/n junctions are less than the 24 hours that were previously devoted to these topics in ECE440 in Spring 2008. As the last subjects to be covered in ECE340, a mere 3 hours are devoted to photonic devices.

Active photonic devices primarily consist of direct gap semiconductors with p/n junctions, *but the optical processes of emission and absorption are of greatest importance*. Therefore the ECE398 proposed course dedicates approximately 8 hours to semiconductors and p/n junction. Thus ECE398 covers aspects of semiconductors and p/n junctions that are no longer included within ECE340.

Thirdly, the 3 hour overlap between ECE329 and the proposed ECE398 is misleading, since the latter is primarily focused on optical fiber technology.

2. Insufficient prerequisites:

In view of the topics to be covered in this proposed course, it requires more prerequisite courses than just Physics 214. (One correction to your response: ECE340 requires ECE329 as the prerequisite in addition to Physics 214). It needs at least ECE329 to understand p-n junctions, the wave equation, and other wave related topics. Of course, if you can reduce overlaps as mentioned above, ECE340 should also be included as a prerequisite.

ECE340 (which was recommended by the CC committee) and ECE329 both have Phys 214 as the sole prerequisite. In a similar manner, the required fundamentals for ECE398 will be developed from what students have seen in Phys 213 and 214.

In summary, the senior level ECE photonics courses (none of which have ECE440/340 as a prerequisite) presently suffer from the lack of any motivating introduction to this important field of electrical engineering and active research area of more than 8 faculty in the Department. The recent revision of ECE440/340 has created a course intentionally focused on Si microelectronic devices. Hence there exists an important need for an elective photonics introduction course to offer the opportunity to our undergraduates for exploration of an equally exciting and important field of study.