CCGB Meeting, December 1, 2006

1. Approval of Minutes
2. Undergraduate Announcements
3. Discussion of Advisor Approved Electives
4. Discussion of request by BEE to substitute Physics 207/208 for Physics 112/213

CCGB Minutes, November 10, 2006

Members:  S. Baker, J. Bartsch, A. Center, E. Fisher, D. Gries, B. Isacks, L. Lee, W. Philpot,
L. Pollack, D. Ruppert, C. Seyler
Ex-Officio:  B. East, R. Evans, R. Robbins, L. Schneider, F. Shumway, M. Spencer
Other:   D. Caughey, B. Kusse, C. Pakkala, A. Ruina

Approval of Minutes: The minutes of the 10/20/06 CCGB Meeting were approved as written.

Undergraduate Announcements: None

Short Discussion of AEM Minor: B. East stated that last spring AEM offered to allow engineering
students in their minor; currently, only CALS students are in it. At this time, only 10 students from
engineering will be accepted into the minor, but there is a donor waiting to give money to CALS to hire
faculty to teach the courses so that more engineering students can take them. The donor wants engineers
to have more of a business background. AEM has received 40 applications from engineering students.
ORIE is not going to allow their students to participate in the minor for the moment. Applications for
the AEM minor are available in 167 Olin or Warren Hall.

Task Force at Cornell University. Each member of the Curriculum Committee has seen and approved it.
Points were discussed vigorously, and disagreements were clear. The committee was charged by Dean
Fuchs to develop recommendations for changes in the common curriculum. The report was built upon
recommendations of the 2005 committee. The committee divided the task into the math/science/com-
puting core, first year experience, engineering breadth, flexibility, and pedagogy. The concerns covered
by this group included those expressed by the 2005 group. There were several over-arching observa-
tions: a need to focus on fundamentals; increasing breadth/depth; currently, flexibility exists but is un-
der-utilized. Engineering education research/policy literature is a mixed bag; there are several clear and
innovative ideas but a lot is worthless for us. Some challenges to discuss.

The balance of what belongs to majors and to the common curriculum is challenging. The current core
courses include 16 credits of math, 16 credits of science, and 4 credits of computing. Only 16 of the 36
credits are common, so it is difficult to define what “core knowledge” is. We need to decide how to best
motivate students in these courses. We also need to decide how to arrange content to maximize learning
and knowledge retention.

A. Center stated that he hears from engineers that they never use lots of this stuff after graduation. He
questioned whether we are teaching stuff that is useful. S. Baker responded that the Curriculum Com-
mitee talked about this. They discussed to what extent students should derive things, i.e. results in math,
physics, etc. It is likely true that practicing engineers won’t do certain things, but going through the
process is a critical part of learning how to think.
The changes are not expensive and difficult, and they should improve the core curriculum. Biology was not included in the proposal because the committee couldn’t identify core biology content. Statistics should be included, but there is no room for it. There is a question of discrete math for CS, ORIE, and ECE. The committee tried to solve the question of what core knowledge is.

We need to integrate math into the science courses. The use of math in context strengthens both an understanding of math and the ability to use math to solve problems. The syllabi should be coordinated so that the math currently being taught is used in the science courses.

A. Center said that it seems obvious that math and science should be integrated, and he wondered why they aren’t currently integrated. S. Baker said that the syllabi are not tied together largely because the math courses are often taught by the Math Department, partly by visiting faculty and post-docs, and each lecturer has their own syllabus.

A. Ruina added that no mechanism exists for the coordination of math in science. There is no official coordination, and faculty members don’t find out what the prerequisites and co-requisites are. S. Baker said that the committee looked at the syllabi for the courses over the years.

A. Center questioned whether we are talking about enforcing discipline on another college. S. Baker replied that we are, but we need to work out the mechanism for doing it. We also need to get engineering into math courses. The two disciplines are disconnected. The math workshops would motivate the use of math to solve engineering problems and build problem-solving skills. The goal is to optimize the content of all math/science/computing core courses for maximum long-term benefit to students. The sense is that some courses cover so much material so thinly that understanding and knowledge retention suffer.

For computing, students need both engineering computational tools and program structure and design. We must be able to integrate computing easily into other courses. We also need to integrate computing into math courses. This motivates the use of computing to solve engineering problems and builds computational problem-solving skills.

A. Center stated that he sees two paths here: graduate school or work. The courses are not much use for students going to work. He questioned whether it is really relevant to look at computational methods to solve differential equations. S. Baker said that computing and solving differential equations are done via a computer. If you don’t put computational methods in math courses, they don’t appear in any other place in the curriculum. The standard in math courses is computation, and students need to understand how these things are implemented. Every engineering student should know how to do this.

S. Baker spoke about the First Year Experience. It is clear that comprehensive, project-based experiences in the first year provide benefits for students. They provide the context and motivation for other courses, an overview of engineering careers and engineering majors, and opportunities to form student study groups. When a student’s engineering identity forms earlier, it is stronger, and students have more academic success and lower attrition rates. This is important for non-traditional engineering students who want to understand the social value of engineering. They can see what engineering is all about and decide whether they like it.

The proposed changes were done by the 2005 Curriculum Committee. Student projects will enhance design skills, teamwork, communication skills, and realistic boundary conditions. There will be a close integration with the math/science/computing core. The first semester classes use Math 191 and Matlab. The second semester courses use Math 192, Matlab or Java, Physics 112 or Chemistry 207. After taking engineering classes, students should have a good idea of what engineering is all about.

The goal for implementation is to have a template for general topics worked out by faculty at the college level, while faculty in different majors will create individual courses/projects and the college will provide resources to assist in teaching of general topics. A wide range of projects is desired.
Second semester courses, when they are created, will be optional at first and then get their own general template. The second ENGRE courses can’t require first semester ENGRE courses as prerequisites. And, we have the possibility of replacing one freshman writing seminar by a second ENGRE course. This should be done only when we are sure that there is enough writing/communication in the ENGRE courses. Our Engineering Communications Program should be heavily involved in the design and implementation of writing/communication in ENGRE courses.

E. Fisher said that a single big course was the committee’s previous recommendation in order to give students good exposure to different majors. S. Baker responded that the first curriculum committee wanted students to have a more uniform experience, but some students come in well prepared and experienced, while others come in with no experience, so this proposal covers the spectrum. No one course would guarantee that students know about all of the majors.

L. Pollack wondered how the proposed ENGRE courses differ from ENGRI courses. S. Baker replied that the ENGRI courses are not all project-based. They don’t have a template of generic engineering knowledge and information built into them. Some have these attributes but many don’t.

A. Center wondered what the problem is that we are trying to solve. If some ENGRI courses work and some don’t, it makes no sense to eliminate all of them. It would be better to fix only those that don’t work. S. Baker responded that the courses we have that currently work are due to the person that created them. There is no requirement that we don’t do something that we’re currently doing. C. Seyler stated that the original intent of the ENGRI courses is what is being proposed, but currently no overseeing body has taken care of the courses. It is best to start this from scratch to make it a better course. We need to have a college group oversee the courses. S. Baker said that the key feature is that every freshman needs to have this experience.

The college would phase the ENGRE courses in over 2-3 years.

E. Fisher asked if a larger number of faculty will be involved in ENGREs than ENGRIs. S. Baker replied that it is possible, but we don’t yet know how big the ENGRE courses will be.

E. Fisher said that an MAE course in the sophomore year has these attributes, but it is a course that not many faculty are willing or able to teach. It requires lots of resources. If more faculty members are being involved in the freshman year, this will be perceived as a difficulty.

S. Baker stated that nobody should look at this as a way of benefiting students not in their program. This benefits all the engineering students in all the majors. Majors will look for opportunities to offer courses that their students will take. Students’ needs will be identified and met. The Dean will worry about resources.

B. East stated that about 55% of students change their mind about their major after they get here; that is a good incentive for majors to offer courses to attract them. The ENGREs will require college support and a group to monitor them.

S. Baker stated that the faculty agree that students should have depth in fundamental but broadly applicable engineering and applied science topics. In practice, majors want specific prerequisites and don’t agree on what constitutes engineering fundamentals. Since 1981, breadth has been reduced from 4 to 2 ENGRD courses and the number of groups has expanded to 8. We need to define a new group of fundamental engineering courses to replace current ENGRDs. ENGRF courses provide depth in fundamental but broadly applicable engineering and applied topics. Students will take two ENGRF courses, one each from two of the following categories: biological science, chemistry and materials, computing, electrical science, mechanics, statistics and thermodynamics. Only one ENGRF may be specified by the major.
Students currently feel they are limited and can’t take the classes that they want, it is difficult to study abroad, and it is difficult to arrange focus areas such as business or language. The common curriculum will be designed so students may choose any engineering major to start off their third semester.

The college, departments, and schools will find ways to increase flexibility so engineering students can take more courses related to their individual goals or to study abroad.

The next steps for the curriculum committee are to communicate the proposal to advisors, faculty, and students. The goal is to have faculty discussion and refinement. It would be nice to have decisions on some implementable topics for Fall 07 at the February Faculty Meeting, if possible. However, which decisions are made at that time is up to the faculty. Decisions on other topics could be made in May 2007.

Many changes are proposed. Most are low cost/high benefit. Some higher cost/higher benefit (ENGRE courses), while some require discussion (ENGRF). This is an opportunity to lead by developing innovations in areas that have been shown to be effective while retaining our core values. Comments from the community are invited.

The meeting adjourned at 9:02 a.m.