Mechanical Engineering SFC Committee Report: 2009

The Mechanical Engineering Committee for the 2009 Student-Faculty Conference was tasked to examine once again the core curriculum of the Mechanical Engineering option for notable dissatisfactions incurred by its undergraduate population. Through a survey specifically addressed towards all students who had declared the option – freshmen included even though they have not had the opportunity to take any specific ME courses – the committee remarked upon the following problem areas:

- core curriculum weaknesses
- the lack of student-faculty interaction
- the lack of breadth in SURF and internship opportunities

Over the course of several committee meetings, solutions were proposed and debated until a possible plan of action for each of the above areas was concluded. These ideas were then presented at the SFC and after the ensuing discussion, the following suggestions have been finalized as the committee's recommendations for improving the Mechanical Engineering option.

Part I. The Core Curriculum

A substantial percentage of the complaints from students regarding current required courses focused on two major classes: ME 65 and ME 35a.

- *ME 65: Mechanics of Materials*

    - The Issue: ME 65 is meant to be a rigorous treatment of the mechanics of solids, and thus, inherently it teaches a highly conceptual and mathematical approach to the topics it presents. Because the class material itself is already very challenging, the fact that the class lacks a central textbook or organized lecture notes poses a serious obstacle toward an effective understanding of the material on the undergraduate students' part. Furthermore, teaching this class concurrently with the graduate-level AE 102a may exacerbate the situation, as there is a significant difference in the level of background between undergraduate and graduate students.

    - The Proposed Solutions: Finding a central textbook, organizing comprehensive lecture notes, and restructuring ME35c so as to provide a better base understanding of the topics in ME 65 are the strongest recommendation we can make. We recognize that the materials of this class may not be covered by any one single textbook, but even if a central text cannot be found, serious attempts should be made to create an easily accessible library of comprehensive lecture notes for the class. In addition, despite the limited resources of the ME department, it would be worthwhile to consider splitting this course from AE 102a such that ME 65 becomes an undergraduates-only class. This dedication towards the undergraduate level of understanding would be beneficial to the learning and comprehension of the presented materials.

- *ME 35a: Statics and Dynamics*

- The Issue: As the first introductory Mechanical Engineering class for undergraduates, ME35a plays an important role in helping students decide whether or not they are interested in the option and preparing them for more advanced courses. The overwhelming concern reflected by the students is that ME 35a tends to be a tedious repeat of materials taught in Ph1a. This causes some few students to lose interest in the option itself and to switch out of the department.

- The Propose Solutions: Creating interesting problems of practical engineering applications and restructuring the presentation of the materials of the class would greatly enhance effectiveness and interest level of the class. Supplementing lectures with interesting videos or actual real-life projects would engage students more during lecture. Also, as problem sets usually consist entirely of problems directly quoted from the textbook, Statics and Dynamics by Beer and Johnston, it would be worthwhile to created more in-depth problems that relate to real-world situations. The combined efforts of the two ideas would not only raise the students' interest of the material, but also help focus on the engineering applications of the principles of statics. More importantly, shifting the focus of the class onto a more practical presentation of the theory and background behind the topics would pave the way more effectively for future ME classes.

In addition to the above, a high number of responses indicated that students desired more design and/or robotics courses and more experience using CAD. During the follow-up discussion, a similar consensus was reached at the SFC and afterwards, UCME chair, Sue Shiao, took it upon herself to write a letter expressing the concerns and suggestions which were brought up to ME option rep, Kaushik Bhattacharya. The following were the issues presented in the letter:

- Requests for a CAD course, and in general to bring back ME 170, Introduction to Mechanical CAD, and ME 171, Computer-Aided Engineering Design.

- Suggestion of a new robotics course, which would lead into ME 115ab, Introduction to Kinematics and Robotics. The main purpose of the class is to teach the usage of various CAD programs and the appropriateness of each. Furthermore, the introduction-level course would also give a basic introduction to robotics using LEGO robots, for those who haven't been exposed to robotics in high school.

- Suggestion of a seminar course, but instead of professors talking about research, companies could come in to talk about what they do. We believe that having such a course would be a big help for those who are interested in industry.

Regarding the proposals above, a group of students have been designated to follow up with Professor Bhattacharya to make sure these changes will be implemented. His response to the letter was promising as can be seen by his replies:

- We agree that we should teach CAD software. In the long-run this should become an integral part of the ME 71/72 sequence with the trend towards rapid proto-typing. In other words, you

should be actively using these tools as a part of these courses. We are hoping that this will start to happen next year, but the exact details will depend on the exact person teaching these courses

- We are hoping to add new courses on robotics offered by people from JPL. We are working on the details now, and I will pass along your suggestions to them.
- We will start something (referring to the seminar course) along these lines next year.

Because of the relatively small ME faculty, and financial issues this year, it will be difficult to implement any drastic changes to the curriculum as far as adding new courses in the immediate future. However in the long run, with the continued demand, there are likely to be changes.

Part II. Student-Faculty Interaction

Based on the survey, and as the result of talking to ME students on campus in general, it is clear that accessibility to the ME faculty poses the main obstacle behind the lack of student-faculty interaction in our department. Busy schedules and administrative duties seem to call the faculty away from engaging with their students, and so we propose the following ideas to ameliorate this issue:

- Asking students to come in to the office for a brief chat. Some professors have already enacted this, and so have a closer relationship with their students. It can be one-on-one, or in a forum-like setting, and doesn't have to take a long time. Setting aside a half hour to an hour on a couple of days can bring in a lot of students if they only stay for 5-10 minutes.
- Office hours should be made with the students in mind. Often, we find that the professors make their office hours to be during the lectures for other required courses, and so we never get a chance to sit down with the faculty like we do with the TA's. It would be worthwhile to pass a brief survey around, asking students for their availabilities before deciding on the date and time.
- Research opportunities can be discussed in class, if they are relevant to the material. What we find is that while a professor may be a great lecturer in a certain subject, we have no clue as to what their actual research topic is. Bringing in examples from research and spending some time talking to students about what the professors do will allow students to have a better understanding of the faculty as well.

Finally, UCME has made major progress this past year in increasing student faculty interaction by creating a ME Social and Impromptu Design Competition. Those in attendance have noted that it was a success, and promoting such UCME-sponsored events through personal invitation to the faculty would be a worthwhile effort on the part of the students. These socials are the best method of increasing student-faculty interaction and make for a fun way to do so as well.

Part III. SURF and Internships

Undergraduates have expressed dissatisfaction regarding SURF. The claim that ME students have one of the lowest SURF proposal acceptance rates is one that needs to be examined in detail and further work should be done to evaluate this fact. Additionally, of those students who do find a SURF, the majority of them end up at JPL. This indicates that our department is lacking in on-campus research opportunities.

For those who are more interested in finding a job post-graduation, the lack of knowledge regarding internships is also problematic. The defense and aerospace industries seem to monopolize the opportunities presented at Career Fairs, and if a student is not interested in either, there seems to be few resources on campus that provide adequate help and guidance in terms of choosing a career.

To address these compelling issues, the committee would like to propose the following:

- Publicize and create a listing of faculty willing to take on SURF students during the summer. If possible, increasing the number of students per lab and the breadth of research topics that would be supported are two ways increase visibility of the SURF program for the ME department on campus. Such actions would most definitely result in boosting student confidence in the SURF system.

- Encourage more industry internships. Students have felt that there is a push for the undergraduates to pursue careers in research or academia, and having faculty advisors to take an active part in helping their advisees find internships that suit the students' interests would not only increase student-faculty interaction, but help the undergraduates focus more quickly on what type of industry they want to enter if their post-graduation plans do not include graduate school. UCME is a group that can be leveraged to this purpose as well, and if they could start compiling a directory of possible opportunities and deadlines, the benefits of that effort would be reaped for years to come.

- Push for the Career Center to invite representatives from other industries besides defense and aerospace to attend the annual Career Fairs. Most likely, this will need to fall on UCME, ASME or some similar student movement, but a commitment to make the Career Center a better resource for ME needs to be initiated and then maintained.

The final idea refers back to the first part of this report, and that is to implement a seminar-style course which will bring in representatives from different companies that employ Mechanical Engineers to talk about their jobs and what their careers demand of them. It would be a great networking opportunity for the students, and it would bring more understanding of how the theory presented in classes translates into real-world applications.

Conclusion

In general, student responses have indicated a desire to see more practical applications of the required materials covered in the courses, and would like to know more about cutting-edge developments in the field. To improve the undergraduate experience as a Mechanical Engineer, we have provided numerous suggestions with the intent of following-up on them so as to implement these ideas in the near future.

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