ENCE 289i - Engineering in the Developing World

Syllabus – Spring semester, 2010

Instructor: Professor David J. Lovell, Civil and Environmental Engineering

Teaching Assistant: Dylan Rebois, Mechanical Engineering

Meeting times and location: MWF 4-5 pm, MCB 1207

Course description: This course will tap into the extraordinary interest on campus in helping third world countries improve their health and well-being while simultaneously promoting sustainable and environmentally benign development. The course covers some basic social, political, economic, and scientific challenges faced when tackling development projects in the neediest parts of the world. Students then learn some of the basic engineering principles behind such life necessities as water, food, shelter, hygiene, energy, and transportation. Students compare the manifestations of these principles in the developing world with the same systems in our country, and discover that the engineering is the same, but that the developing world can be a better learning laboratory because frequently these systems have to be built from scratch. Perhaps most importantly, the course will cover mistakes and missteps that have been made in the transcript of the developed world, gaining insight into how some of these can be avoided when partnering with underdeveloped communities. The course dovetails into the campus chapter of Engineers Without Borders, and can serve as a training vehicle for that organization, particularly for students from non-engineering majors.

This course aims to give students a better understanding of how many of their basic daily needs are provided through engineering. It marries this pedagogical goal with the broad popularity amongst students of contributing to underdeveloped communities. This pairing allows students to see these engineering systems in a much more raw environment, where the engineering principles are on full display, rather than being masked with the over-engineering and aesthetical treatment typical of (and necessary for) the developed world. Students also learn how local materials availability and economics affect engineering design decisions. As a result, students will understand their own situation better, they will appreciate the layers of innovation that accompany our more comfortable existence in the developed world, yet they will see the connection to a path forward for underdeveloped communities that can hopefully lead to the same ends, perhaps avoiding some of the social, economic, and environmental mistakes that can be made when these systems are new and poorly understood. They will learn how to objectively compare different engineering solutions for the same basic problem that might prevail throughout the world. The course will cover water supply and water quality, food production and sanitation, structures for living and working, individual and community hygiene to include waste and wastewater treatment, energy, and transportation.

To make the course manageable, student teams will be employed to pursue many of the goals collectively. In some cases, a particular engineering system, such as water supply, can be attacked by teams each looking at a different country’s approach, as it is affected by the country’s geography, climate, and natural resources. In other cases, students can be grouped according to technology, for
example distinguishing between various modes of energy provision, such as solar power, fossil fuels, hydroelectric, etc. Students will be required to give in-class presentations on their findings so that everyone in the class will benefit from the efforts of each of the teams.

Students will gain knowledge through lectures, reading assignments, guest lectures by experts from international aid and development agencies headquartered in Washington, and their own research outside of class. Student deliverables will include group presentations and reports, individual reports on selected topics, and exams. Student evaluations will include an individual assessment that covers individual assignments, exams, and class participation, as well as group assignments for reports and presentations delivered collectively.

The course is intended to have a close connection with the Engineers Without Borders (EWB) chapter on campus. Current teams from EWB will be asked to make presentations on their recent implementations. Furthermore, since the EWB chapter is increasing its activity in local sustainable engineering projects, the class will take at least one field trip to the local site whenever such a project is underway coincident with the class, preferably during the implementation part of the project, allowing the students in the class to gain some hands-on experience and contribute in a material way to the success of the local projects.

All of the students in the class should emerge with a newfound appreciation for the science and engineering underpinning the provision of the basic necessities of life. They will learn that the continued provision of these necessities is by no means a solved problem, and represents a difficult and enduring challenge for governments, scientists, engineers, and peoples across the world. Hopefully, many of the students will also gain the confidence to realize that they can spend some or all of their lives contributing in some way to improving conditions for those less fortunate, or perhaps pushing the envelope for the developed world as well, but in a manner that is more sustainable and more in harmony with nature’s competing interests. The students will appreciate the university as the ideal proving grounds for this type of endeavor. We combine a wealth of disciplinary domain knowledge and intellectual resources with the pervasive attitude of critical and skeptical approaches to understanding our own history and situation, and we can channel these forces together with the indomitable energy and hope of young students to produce a generation of knowledgeable, skillful, and compassionate citizenry.

Course Topics:

- Engineering systems (water supply, sanitation, transportation, energy, agriculture, housing) (6 weeks)
- Social issues (1 week)
- Project assessment (1 week)
- Development organizations (EWB, Peace Corps, World Bank, etc.) (4 weeks)
Grading:

- Midterm exam (25%) Wednesday March 10
- Final exam (25%) Wednesday, May 19, 1:30 pm
- Individual report (written) (10%)
- Group report (written) (10%)
- Group report (oral) (10%)
- Friday quizzes (10%)
- Participation / attendance (10%)

Quizzes will be given on some Fridays, with no advance notice and no make-ups without prior permission from the instructor. The midterm and final can cover any material presented in class, by any individual or group, as well as additional assigned reading outside of class.

The individual reports will be due Friday, March 12, the last day before spring break. A proposal for the individual reports is due Friday, February 19, and the report topic must be approved by the instructor. Students are encouraged to show drafts of their reports to the instructor and/or teaching assistant prior to final submission.

The teams for group reports will be formed after spring break, and topics will be assigned by the instructor. The group presentations will be made in the last weeks of the class, and the group written reports are due on the day of the final exam.