**English 206**
**Final Exam**
**Spring 2005**

**Name:**_____ **Section:**_____

**Instructor:**_____ **Time Allowed: 2 $^{1/2}$ Hours**

Passage A

Colorado Program Lets Kids Try their Hand at Engineering

A Colorado program is sending engineering students into K-12 classrooms to get kids interested in the field and, through hands-on projects, to show them the creative side of the profession. The Integrated Teaching and Learning (ITL) program, based at the University of Colorado (CU) at Boulder, aims to improve engineering education at the postsecondary level, and to reach students before they get to college.

Encouraging interest

In ITL's K-12 outreach program, CU-Boulder undergraduates and graduate students work with fourth-through 12th-graders during the school year to get them interested in engineering. The ITL Laboratory also offers a variety of summer programs, such as internships for high school girls; K-12 teacher workshops; and short-term classes for students of different ages.

The school-year program sends graduate and undergraduate fellows into classrooms starting in fourth grade. "We do think that grabbing the kids when they're younger is going to help them understand what engineering is and get excited about it," said Malinda Zarske, a K-12 outreach coordinator for the program. "We think that by the end of elementary school is when students start to decide whether they like math and science or not."

The ITL program has several sources of funding, but it is supported primarily by federal dollars, with grants from the National Science Foundation's Graduate Teaching Fellows in K-12 Education program and Digital Libraries initiative; and from the Education Department's Fund for the Improvement of Postsecondary Education. "What we try to do is bring in the applications of the math and science they're already doing," Zarske said. "All of our activities are hands-on," she added. For example, one ITL fellow developed a middle school unit on the Mars rover. Students designed mini-rovers of their own; launched them; and explored ways to land them gently, using eggs.

Students also get a chance to be creative with open-ended projects that have to be conducted within certain parameters. "We give them a problem or challenge, tell them that they're engineers, give them some constraints or requirements, and otherwise let them run with the assignment," Zarske said. For example, elementary school students might be told to design a structure that spans six inches, can hold a certain number of books, and is built with only the materials provided. "When they accomplish the task,

they get so excited," Zarske said. "When they succeed and they do something we didn't even think of ... it's even better."

The design projects also can teach students the value of trial and error. They learn that "if it's not perfect the first time, you can go back and fix it," Zarske said.

Broader goals

The ITL program and others like it were created with an eye toward not only recruiting more students to engineering, but also to improving engineering education at the college and university levels. A report issued this spring by the Lemelson-MIT program--which recognizes inventors of all ages--lamented that education in general and engineering education in particular do too little to foster inventiveness. "We're trying to explain to students that engineering is not just somebody sitting in front of a computer. It's a creative field," Zarske said.

Fellows in the ITL program stress the creative, yet practical, aspects of engineering in an effort to draw in students who in the past have been less interested in the field. "Applications that help other people and contribute to society are particularly appealing to girls--who traditionally have been underrepresented in engineering," Zarske said. "We realize that not all kids are going to be engineers," she added. "But teaching them what engineers do can help improve technological literacy in general."

Excerpted and adapted from: What Works in Teaching and Learning, June 2004 v36 i6 p1(2).

Passage B

Purdue Counters Trend, Engineers Education From the Ground Up

WEST LAFAYETTE, Ind., April 9 (AScribe Newswire) -- Purdue University is taking steps to stem the decline in high school students' interest in careers in engineering.

The university's Board of Trustees voted today (Friday, 4/9) to create a new Department of Engineering Education to increase younger students' interest in engineering while researching ways students learn engincering concepts. The department is the first of its kind in the nation, but other universities across the nation also are studying the problem.

The initiative is aimed not only at increasing student interest but also at responding to the projected demand for more engineering professionals. One recent study showed that the number of high school seniors planning on careers in engineering has dropped more than 35 percent in the past 10 years. At the same time, the U.S. Bureau of Labor estimates that the number of jobs to be filled in engineering and science will grow at more than three times the rate of other professions. "There is a dramatic need for engineers who will be able to lead this country and the world into new technologies and innovations," said Purdue Provost Sally Mason. "As emerging fields such as nanotechnology and biotechnology grow, it will become even more imperative for

universities like Purdue to understand how best to educate the new generations of engineers, both on our campus and before they enter Purdue."

The new department will combine Purdue's existing freshman engineering and interdisciplinary engineering programs. In the future, it plans to offer graduate degrees for students studying the science of learning and other topics in engineering education. There also are plans to add an engineering teaching certification program for high school teachers and to pursue accredited undergraduate degrees in engineering education and interdisciplinary engineering.

Engineering education reforms have not only been called for by engineers at Purdue, but also by leaders in the field from around the country. Linda P.B. Katehi, Purdue's John A. Edwardson Dean of Engineering, said the American Society for Engineering Education, the National Research Council, the National Academy of Engineering and other leading professional organizations have all supported the need for a systematic reform in engineering education. Today, the National Science Foundation's support for education reform with an emphasis on engineering exceeds $200 million per year, she said. "There is a great need for engineering education reform, and many important, prestigious organizations are beginning to address that need," Katehi said. "While Purdue is the first university in the country to dedicate an academic department to engineering education, others, including Virginia Polytechnic Institute, are also planning similar departments. That kind of commitment across the discipline will be needed before real reform can become a reality."

Kamyar Haghighi, head of the new department, said research also shows that women and minorities are vastly underrepresented in many math- and science-based fields, including engineering. High-school boys and girls took upper-level math and science courses at about the same rates, but in 1999 women represented only 20 percent of the total enrollment in American engineering programs.

"Engineering is one of the few careers that students coming out high school have likely had no contact with, whether in school, on television or through their own experiences," Haghighi said. "If we are going to continue to produce the world's best engineers, it is imperative to strengthen the pipeline to K-12 education. Part of that is to perform research that will help us understand how best to teach engineering concepts to a wider variety of students, increasing the pool of students who will be both prepared for, and interested in, a career in the field."

Purdue's Department of Engineering Education will initially focus on research and outreach programs, but officials plan to have a program for educating certified high school teachers with an emphasis in engineering by 2006. Besides teaching high school engineering courses, teachers would be qualified to teach mathematics, physics and other sciences and have the knowledge to bring engineering concepts into the classroom.

The majority of the new department's outreach efforts will focus on professional development for educators and bringing engineering into K-12 schools. Following models used in other disciplines, the department and its faculty will work with classroom teachers to develop curricula to introduce younger students to the higher-level thinking common in the problem-solving and design principles of engineering.

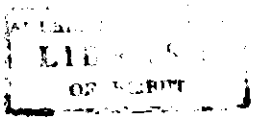
To further expose domestic students to engineering as a career possibility, Haghighi also plans for the department to create programs to complement existing activities that put Purdue engineering students in K-12 classrooms. This will not only

allow younger students to understand engineering, but it also can expose girls and minority students to role models in the field, increasing the likelihood they will consider an engineering career, he said.

Haghighi said faculty in the department will focus research on the science of learning, the role of technology in education, assessment of student learning, diversity and learning environments, and other topics leading to the improvement of engineering education. "If we can find ways to teach a wider variety of students better, we can open the field of engineering to more students beginning at a younger age," he said. "When scientists began to study methods of science education, it caused a large culture shift in the field, but now the idea that we wouldn't study science education and train science teachers is unthinkable. We are beginning to see engineering education on that same path."

The College of Engineering includes more than 6,400 undergraduate students and almost 2,500 graduate students. In its most recent rankings, U.S. News and World Report named Purdue the No. 8 engineering program in the country, and many of Purdue's programs were ranked in the top 10 nationally.

Excerpted and adapted from: Ascribe Higher Education News Service, April 9, 2004 p NA.



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**Name:**_____ **Section:**_____

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**1.** You have read passages A and B about the Colorado program and the Purdue University initiative and were impressed by these attempts to reform engineering education in U.S. schools and colleges. Being an AUB engineering student yourself, you feel that there is a need to initiate similar programs and initiatives in Lebanon and to make more school children, including females, interested in math and engineering career paths; for you, too, believe that tomorrow's engineers are in today's classrooms.

On behalf of the Student Representative Council in the Faculty of Engineering and Architecture, write a **proposal** to your Dean, Professor Hajj, suggesting that every engineering student be required to conduct a workshop in a local school to replace one of his/her required courses.

Use the relevant ideas in passages A and B to write your report. Use your discretion to supplement this information with needed details from your general knowledge.

**1.1 Before writing the report, analyze the situation by answering the following questions briefly. (10 pts.)**

1.1.1 In addition to reading about the subject, you have conducted primary research in local schools to gather accurate information on the issue at hand to be used later in your proposal. Mention two techniques you have used in this research, justifying why each was especially suited to gather the needed data, and indicate if and where you will mention these techniques in your proposal. (5 pts.)

Technique one: _____

_____

_____

_____

Technique two: _____

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1.1.2. As part of your proposal, you will be addressing the gender gap in engineering. Explain how you can make sure that your own language in the proposal does not reflect gender bias. Provide two examples (5 pts.).

**1.2 Write your report in the memo format on** pages 3 and on. (Use the back of the sheets for drafting if needed. You will **not** be given extra sheets of paper for drafts.) **(50 pts.)**

2. Assume the role of Dean Hajj (to whom you addressed your proposal), and write a memo as a reply, **rejecting** the Student Representative Council proposal. After analyzing the situation and considering your audience, use the appropriate approach, style and tone and include all necessary details.

Write your memo on page 8. (Use this page for drafting.) **(40 pts.)**