

## **Engineering Seminar # 2: Engineering Education**

Speaker: Dr. Richard A. Miller, Professor, Department of Civil and Environmental Engineering, University of Cincinnati

Date: June 24, 2009

Time: 3:00 to 5:00 p.m. (2 hours)

Prepared by:

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This seminar was given by Dr. Richard A. Miller, Professor, Department of Civil and Environmental Engineering, University of Cincinnati on June 24, 2009 in 641 Baldwin Hall from 3:00 to 5:00 p.m. He showed pictures of the different

Dr. Miller is a faculty member in the area of structural engineering and civil engineering materials in the Department of Civil and Environmental Engineering. His main research focus is Concrete Materials, Prestressed and Reinforced Concrete, Testing and Evaluation of Structures, and Bridge Performance Evaluation Using Destructive and Nondestructive Testing Techniques.

Dr. Miller started the seminar by making the teachers aware that 2009 was the International Year of Astronomy, 400 years since Galileo! He showed pictures of different Orion Telescopes and how they evolved over the years, and the role of engineering in creating them. He challenged the teachers to show how math is used to show the derivation that a parabolic mirror reflects light through the focal point. He went through the derivation and then showed how it was used in the design the different telescopes as they evolved over the years. Through this exciting example he showed how engineering has been used to make some of the discoveries that we marvel today.

Dr. Miller talked about what engineers do and qualities that students should have in order to be successful at engineering. First, students who possess a "figure it out" attitude will have an advantage over students who "just want to know the answer." Heart is very important for a student wanting to spend his/her working life in this profession, and a student's heart rate during Apollo 13 would be a good indicator. However, along with heart incoming engineer students must meet some entrance requirements. Some of them are summarized below:

- 4 years of math (at least through trigonometry)
- 3-4 years of science including Biology, Chemistry, and Physics
- 4 years of English (yes, engineers must write)
- 26 on the ACT or 1370 on SAT

Other topics during Dr. Miller's presentation described the typical entrance requirements, math requirements, and typical schedule of classes incoming engineering students will take. The typical entrance requirements include:

- Math – 4 years at least through Trigonometry
- Science – 3- 4 years
  - Chemistry
  - Physics
  - Biology (for some programs)
- English – 4 years
- Foreign Language (Not required at UC)
- Other University Requirements

The University of Cincinnati gives a math placement test to all incoming freshmen. The maximum score on the test is a 1450; and students who score a 670 or above take Calc 1, students who score 500-670 take Calc 0 (trigonometry and algebra review), and students who score <500 cannot take Chemistry and must take college Algebra 2 and Trigonometry. Analysis of students' Calc 1 scores shows that students who get a C or lower in Calc 1 DO NOT graduate from UC with a degree in engineering.

A typical engineering curriculum at University of Cincinnati is divided into:

- Math:
  - Calculus
  - Differential Equations
  - Matrix Algebra
  - Statistics
  - Advanced Topics as needed (i.e., Complex Numbers for EE)
- Science
  - Chemistry
  - Physics
  - Biology for some programs
- Engineering Sciences
  - Mechanics of Rigid Bodies (Statics/Dynamics)
  - Mechanics of Deformable Bodies
  - Thermodynamics/Heat Transfer
  - Fluid Mechanics
  - Electric Circuits
  - Computer Programming
    - Basic Material Science
- Other engineering courses taken are discipline specific

Division of a curriculum in engineering is as follows:

- Discipline Specific Courses.
- Required Courses – All students in the discipline must take. Example - All students in CEE take Structural Analysis and Hydraulics, regardless of area of concentration.
- Distributional Departmental Electives: Example – All students in CEE must a structures elective, a geotechnical elective, a hydraulics elective and an environmental elective.
- Area of Concentration Electives: Example – Course specifically in environmental.
- English
  - General Composition
  - Technical Writing
- General Education Courses
  - In humanities, social sciences and the arts.
  - Distribution set by University rules.

Dr. Miller presented a typical freshmen, sophomore, pre-junior, junior and senior engineering curriculum.

Dr. Miller also talked about special programs, including the required cooperative (co-op) program at College of Engineering and Applied Science at University of Cincinnati. Engineering at the University of Cincinnati is a very desirable program mostly because of the school's co-op program. He also talked about the ACCEND program, which is an accelerated B.S./M.S. program, and the Freshman Engineering Program (FEP), which is for incoming freshmen who are undecided about a major or who meet a certain minimum requirement, but don't meet a specific departmental requirement.

Dr. Miller ended the seminar by discussing the retention/attrition rate of engineering students, which is officially is about 65% at University of Cincinnati. He then gave his opinions about why student

transfer/quit. He said that the largest reason is poor grades, and in most cases, it is an inability to adjust to college life, including:

- Social activities
- Drugs/alcohol
- Poor study/work habits
- Outside work demands
- Improper HS preparation
- Personal problems
- Rarely is it a case of a student who “isn’t smart enough”
- Don’t want to be Engineers
  - Parental pressure to “get a real job”.
  - Didn’t really understand what engineering is.
  - Expectations of parents, teachers, peers, councilors (“You’re good in math, you should be an Engineer!”)