DESIGN IN MATERIALS COURSES? NATURALLY!

C. O. Smith, G. Kardos
Engineering Consultant/Mechanical Engineering
1920 College Ave./Carleton University "
Terre Haute, IN 47803/ Ottawa, ONT. KIS 5B6

A difficult in both ABET and CEAB accreditation procedures is providing sufficient "design" content in the curriculum. Both accreditation Boards view "design" as an open-ended process which requires students to formulate problem statements and specifications, consider alternatives, consider feasibility, include realistic constraints, and make reasonable decisions, i.e., for students to think and act. The question, especially in engineering science courses, is: "How can this be done?" The skills necessary to carry out the design process can not be learned by listening to lectures but must be acquired by practice. Engineering cases and consulting problems are excellent ways to provide context for practicing these skills.

Engineering Cases

An engineering case is a written record of an engineering activity as the work actually progressed. Cases are often written, or may be presented, in segments with each portion terminating at a critical decision point. Cases illustrate examples of good and bad engineering. Since cases represent real engineering activity, the judgments and decisions required of students can be critically compared by them and their peers with those made by the professionals in the case. Students discover their decisions may be as good as those made by the principals in the case, and perhaps better. Even when answers differ, exploring the nature of the difference and the underlying reasons can be valuable. Emphasis in case use is on how results were obtained rather than demonstrating validity of a solution.

Cases can be used in many ways to develop desired skills. How and where cases are used depends on course objectives, nature of the class, and style of the instructor. Having students wrestle with problems in realistic contexts will produce new insights that can provide abundant and unanticipated rewards for students and instructor.

Cases can be used (1) as vignettes of engineering history and experience, (2) as amplification or application of lecture material, (3) for introducing new or ancillary technology, (4) as problem sources, (5) as bases for design projects, (6) as bases for laboratory exercises, and (7) as general learning and educational resources. There is no right or wrong way to use cases, simply a variety of ways to bring reality into the classroom to enhance the learning process. Use of cases is limited only by the limits of the instructor's effort, imagination, and ingenuity.

The ASEE Engineering Case Library (at Rose-Hulman Inst. of Tech.) is the major source of engineering cases with some 35 cases having significant materials aspects.

Consulting Problems

A variation on case use is to use a series of problems such as one might encounter as an engineering consultant. Students may receive the problem situation in the form of a letter from a client. Students (individually, or in small groups) are expected to define the problem, develop a feasible solution (usually including material selection, component geometry, forming, heat treatment, inspection, economics, etc.) and reply in letter form. Problems of this sort can come from many sources.

A copy of the complete paper can be obtained by writing one of the authors or calling Web site: http://www.civeng. carleton.ca/ECL/dsgnmat .html