

# Capstone Design Course EE Department Principles

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Approved by the EE Faculty December 5, 2013

The capstone design experience in the EE Department should include the following principles:

## **1. Open Ended**

The design problem should have multiple reasonable and feasible solutions, without an obvious single best solution. The solution space should have a high dimensionality. Substantially different problem solutions should be possible. Design problems might have many different optimal solutions. Projects should require tradeoffs and balancing of conflicting constraints.

## **2. Creative**

The design problem should require innovation, exploration and synthesis of ideas on the part of the students. It should not be a straightforward application of material directly from lecture, text or internet.

## **3. Major**

The design problem should be pursued over a majority of the quarter, and involve a substantial amount of student effort. There should be at least seven weeks of open ended design from design proposal to final project report. Course grading should be at least 70% based on the design project grade. Lecture material in the design course should be specific to the design project, and not teach unrelated new material. Quizzes, homework and pre-set laboratory experiments should also specifically support the design project. Non-project student work should be minimized in favor of open ended design. The design project may be presented as a single problem or assigned and solved in a succession of related steps.

## **4. Rigorous**

Design problems must involve significant engineering design, chosen based on the topic area, as well as students' and instructors' skills and background. The problem should require the application of skills and tools taught in electives associated with the topic area. Creation of a physical instantiation of the design is preferred, if possible. Detailed and accurate simulation of design performance in lieu of physical construction is acceptable when physical instantiation is not possible.

## **5. Teamed**

The problem should be solved by teams, not individually. All members of a single team should be engaged on the same design problem.

## **6. Communicative**

The students should be required to submit written reports and give presentations on their designs. Class or section size should be limited as necessary to enable presentations. Design project reports should explicitly include discussion of the engineering standards used and realistic constraints observed in the design.

## **7. Assessed**

Design projects should be critically assessed and graded on the quality of the design rather than effort. Assessment may necessarily have a high subjective component. Involvement of outside expertise (industrial visitors, for example) and other students in the class in the assessment process is encouraged. Assessment should have a significant group component, and a significant individual component.

## **8. Realistic**

Design projects should be as close to real world design problems as the topic area and time and resource limitations allow. They should, whenever possible, require designs to conform to appropriate engineering standards adopted by recognized standard-setting organizations. IEEE numbered standards are preferred where appropriate. Design projects should require designs to conform to multiple (more than one) realistic constraints from the list in student outcome C. As of 2013 the realistic constraint list is: economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability. Problem solutions should reflect the state of the art in the topic area (not necessarily attempting to advance it). Assessment should favor the more pragmatic solution.

## **9. ABET-Compliant**

Capstone design courses should address the ABET Engineering Criterion 1 outcomes required of capstone design courses by the EE faculty. As of Autumn quarter 2013, these were: (b) experiment, (c) design, (d) teams, (g) communications, (h) breadth, (i) life-long learning, and (j) contemporary issues.

Capstone design projects should provide the major design experience described in ABET Engineering Criterion 5.