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Undergraduate-Syllabus Attachment: Grading Standards

Grade Components: In courses coded TH (“Theory”), as distinguished from LB (Laboratory), DS (Discussion) or IS (Independent Study), the following elements are graded:

- (w) Class attendance, discussion participation, recitation, and/or pop quizzes, demonstrating not only the ability to function in a group, communicate orally, and engage in learning, but also an understanding of professional ethics, a knowledge of contemporary issues, and an appreciation of the societal impact of engineering solutions;
- (x) Homework assignments, design projects, and/or term papers, demonstrating the ability to identify and formulate problems, to design systems, components, and processes, to use techniques, skills, and modern engineering tools, and to communicate in writing;
- (y) Average of midterm and other 50-minute tests, demonstrating the ability to apply knowledge and solve problems; and
- (z) Comprehensive 100-minute final examination, demonstrating the ability to identify, formulate, and solve problems.

Each element will be represented by a score ranging from zero to 1.00 (100%).

Grade Computation: The overall score will be calculated not by averaging these elements, but from a weighted product similar to

$$w^{0.125} \times x^{0.25} \times y^{0.375} \times z^{0.25}$$

The weighting exponents will be announced for each course. The letter grade for the semester will be “curved” by plotting the score distribution for the entire class on a histogram, and finding appropriate break-points. The average is expected to be around B-, but in the professional judgment of the instructor, the current class might be performing higher or lower than the larger population of engineering students, so that the class average might come out higher or lower than B-. The number of A’s will also vary: for example, the histogram of scores of one class may form a narrow bell-shaped curve, with few stand-out scores deserving A’s; while the histograms of another class may have two widely-separated peaks, leading to numerous A’s and C’s, but few B’s.

Caution: Being an engineer involves more than the ability to grind through “cooked-up” problems and pass standardized tests. If we used the traditional weighted-addition method, it could be possible for a student to get a passing grade while skipping attendance or homework, if he or she excelled in test-taking. However, since we will use a product of the grading elements, a zero on any one grading element leads to a zero semester grade as well.

Rationale: The value of our undergraduate degrees depends in part on ABET accreditation of our program, which requires that we ensure that each student can demonstrate the following eleven outcomes:

- a. An ability to apply knowledge of mathematics, science, and engineering appropriate to the mechanical and aerospace engineering disciplines.
- b. An ability to design and conduct experiments, analyze and interpret data.
- c. An ability to design [both thermal and mechanical] systems, components, or processes to meet desired needs.
- d. An ability to function on teams, some of which require consideration of multiple disciplines.
- e. An ability to identify, formulate, and solve engineering problems.
- f. An understanding of professional and ethical responsibility.
- g. An ability to communicate effectively
- h. The broad education necessary to understand the impact of engineering solutions in a societal context.
- i. A recognition of the need for, and an ability to engage in, life-long learning.
- j. A knowledge of contemporary issues.
- k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional subject-area outcomes, reflected in our required curricula, are specified for Mechanical Engineering degrees and for Aerospace Engineering degrees.

Any one particular course will demonstrate several (but not all) of these outcomes: many engineering-science and most mechanical-engineering courses will include **a.**, **e.**, and **k.**; design-oriented courses will also include **c.** and often **d.**; but **b.** will generally be emphasized only in LB (laboratory) courses, and “Measurements and Instrumentation” will include eight of our eleven outcomes. Underrepresented outcomes, such as **j.**, may be covered in seminars.

In order to meet ABET requirements, every student must show all eleven outcomes. Since some outcomes are represented in only one of the grading elements, it is necessary to develop evaluation schemes which require each student to show adequate performance in each grading element.