

# ECE 360 Knowledge Probe – Spring 2009

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**Course Coordinator:** EdI Schamiloglu

**ABET Outcomes probed:** A, E.

**Relevant prerequisite classes:** ECE 213, PHYS 161, Math 264

## 1. Instrument

The knowledge probe (KP) consisted of a 10 questions given to students in the class during the first week of the semester. The class was taught by Prof. Jamesina Simpson. Students were given 20 minutes to answer the questions. The KPs returned by the students are attached.

### Question 1

This question was meant to address outcome A. This question probed whether students understood the fundamental difference between an electromagnetic wave, which requires no medium in order to propagate, and an acoustic wave, which requires a medium in order to propagate. It is expected that 90% of the students would respond correctly.

### Question 2

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in PHYS 161 (a course prerequisite). Some students might not recall what is meant by a static field. It is expected that 75% of the students would respond correctly.

### Question 3

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in PHYS 161 and Math 264 (course prerequisites). The question asks about a fundamental property of vectors. It is expected that 75% of the students would respond correctly.

### Question 4

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in PHYS 161 and Math 264 (course prerequisites). The question asks about a fundamental type of vector that has unit amplitude and provides information on direction. It is expected that 75% of the students would respond correctly.

### Question 5

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in PHYS 161 and Math 264 (course prerequisites). The question asks about a fundamental relationship between a vector quantity on a surface and its value within a volume. It is expected that 50% of the students would respond correctly.

### Question 6

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in PHYS 161 and Math 264 (course prerequisites). The question pertains to the definition of the dot product. It is expected that 50% of the students would respond correctly.

### Question 7

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in PHYS 161 and Math 264 (course prerequisites). The question probes whether the student can correctly calculate the gradient of a scalar field. It is expected that 50% of the students would respond correctly.

### Question 8

This question was meant to address outcome E. The knowledge necessary to answer the question should have been gained in ECE 213 (a course prerequisite). The question probes the students' ability to identify, formulate, and solve engineering problems by probing whether the student understands the advantage of the Laplace transform method in solving for the transient response of a circuit. It is expected that 75% of the students would respond correctly.

### Question 9

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in ECE 213 and Math 264 (course prerequisites). The question probes the students' understand of the response of an *RLC* circuit, which is described by a 2nd order linear differential equation. It is expected that 75% of the students would respond correctly.

### Question 10

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in ECE 213 (a course prerequisite). The question probes the students' ability to plot a step response in the time domain. It is expected that 75% of the students would respond correctly.

## 2. Results

Thirty-five students took the knowledge probe, and every student answered every question. Thus, the allotted time appears to be sufficient for all students to answer the questions to the extent necessary to demonstrate their knowledge.

### Question 1

29 out of 35 students answered the question correctly. Of the 6 students who got it wrong, five of them answered (a). It seems they were confused by the term "whistler wave." Only one person answered (d).

### Question 2

16 out of the 35 students answered the question correctly. Of the 9 students who got it wrong, only one selected option (e), I do not know. The remainder were almost evenly distributed among the other wrong answers.

### Question 3

23 out of the 35 students answered the question correctly. Of the 12 students who got it wrong, 8 of them selected option (b).

### Question 4

24 out of the 35 students answered the question correctly. Of the 11 students who got it wrong, 2 selected option (e), and the remainder were almost evenly distributed among the other wrong answers.

### Question 5

18 out of the 35 students answered the question correctly. Of the 17 students who got it wrong, 4 selected option (c).

### Question 6

24 out of the 35 students answered the question correctly. Of the 11 students who got it wrong, 2 selected option (e), and 8 selected option (b).

### Question 7

22 out of the 35 students answered the question correctly. Of the 13 students who got it wrong, 6 selected option (e), and the remainder were almost evenly distributed among the other wrong answers.

### Question 8

25 out of the 35 students answered the question correctly. Of the 10 students who got it wrong, 4 did not put anything down, and the other 6 used terminology from circuits class but gave the wrong answer.

### Question 9

29 out of the 35 students answered the question correctly. Of the 6 students who got it wrong, 2 selected option (c).

### Question 10

21 out of the 35 students answered the question correctly. Of the 14 students who got it wrong, 12 did not know what a step function was.

## 3. Analysis

Only the outcome of question 2, which should have been learned in PHY 161, was drastically lower than expected (46% answering correctly). The outcome of questions 1, 3, 4 and 10 were slightly lower than expected, but the outcome of question 5 met expectations and of questions 6, 7, and 9 exceeded expectations. So the students seemed to recall basic concepts of circuits well, except in exactly what the step-function is. The mathematics preparation of the students about met or exceeded expectations. But Physics seems to be the area in which they are lacking preparation for this course.

#### **4. Suggested Actions and Follow-up**

- Knowledge of Physics 161 should be probed more deeply in future KPs. In addition, the results of this KP should be discussed with the Physics Department to see if they might be able to provide some insights on the results.
- The mathematics background was about at the expected level. We need to continue to have a dialog with the Mathematics & Statistics Department about Math 264, and the needs of our students.
- Knowledge of ECE 213 material should be probed more deeply in future KPs. In addition, the results of this KP should be discussed with those in the Department responsible for ECE 213 to see if they might be able to provide some insights on the results.