

ECE 213 Knowledge Probe - Fall 2009

1. Instrument

The knowledge probe (KP) consisted of a three questions given to students in the class as a separate closed book portion of the final exam. The class was taught by Dr. Edward D. Graham, Jr.. Students were given thirty minutes for this closed book part of the exam. The KP's returned by the students are attached.

Question 1

This question was meant to address outcome A. In particular, this question was meant to determine if students have a very basic knowledge of impedance and related complex frequency domain quantities. The question involves filling in a table of the relation between R, L, C, Z, Y, X, etc. The knowledge necessary to answer the question should have been gained (at the very least) in ECE 203 (a course pre-requisite). *A priori*, I expected 70% of the students to answer this question correctly.

Question 2

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in ECE 203 (course prerequisites). The question dealt with calculating instantaneous and time-average power dissipated in R's, L's, and C's. *A priori*, I expected 90% of the students to answer this question correctly. A summary of results for each test question is included.

Question 3

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in Math 162 and 163, ECE 203 (course prerequisites), as well as in ECE 213 (the current course). The question itself dealt with phasors, complex numbers, and linear circuits (systems). I expected 90% of the students would answer the question correctly.

2. Results

Fifteen students took the knowledge probe, but not every student answered every question. Thus, the allotted time appears to be factor for students to answer the questions to the extent necessary to demonstrate their knowledge.

Question 1

No student got all answers correct and the class average was a miserable 22%.

Question 2

No student answered the question completely correctly, and the class average on this question was only 16%. Six students answered received zero credit for this question. Most students seemed to be confused with calculating power from non-sinusoidal voltages/currents.

Question 3

One student answered the question completely. Seven others answered more than 70% correctly, and three answered less than half correctly.

3. Analysis

The mathematics preparation of the students (complex numbers, Q3) actually exceeded my expectations. All students in the class seemed to have little or no trouble performing calculations with complex quantities. However, students appeared to have run into trouble by "memorizing formulas", for example for phasor addition and power quantities for sinusoidal voltage/current, but where not able to apply a fundamental understanding of the underlying concepts to signals with multiple frequencies (linear systems/phasors) or non-sinusoidal signals. Obviously, the results of this survey were very disappointing.

4. Suggested Actions and Follow-up

Increased emphasis should be placed on understanding underlying fundamentals, rather than "application of formulas" to straightforward problems. More practice should be given with non-time-harmonic cases, and cases with multiple frequencies, in particular.

5. Additional Comments

Since I was assigned to teach the following-on ECE-213 Circuits II course, I devoted considerable time (approximately 10 class meetings) to a review of the Circuits I materials and, immediately after the survey, I reviewed the entire questioning and explained why certain approaches are correct while other are not!

Student	1 Element Definitions	2 Power	3 Phasors	8-9-9 TOTAL
1	2	4	2	8
2	2	4	6	12
3	3	3	6	12
4	2	2	1	5
5	1	2	6	9
6	1	0	6	7
7	1	0	0	1
8	1	1	2	4
9	1	3	7	11
10	1	0	0	1
11	2	0	6	8
12	2	2	8	12
13	2	0	4	6
14	2	0	4	6
15	3	1	6	10
	26	22	64	112
Average	1.733	1.467	4.267	7.467
	8	9	8	25
	21.67%	16.30%	53.33%	29.87%