ECE 213 Knowledge Probe – Fall 2008

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 Prof. Mark Gilmore. 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 90% 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.

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, 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

Eleven students answered the question completely or essentially correctly. Two others answered more than 70% correctly, and two answered the question less than half correctly.

Question 2

Only one student answered completely correctly, and one student answered more than 70% correctly. Thirteen students answered less than half correctly. Most students seemed to be confused with calculating power from non-sinusoidal voltages/currents.

Question 3

Seven students answered the question completely or essentially correctly. Five others answered more than 70% correctly, and three answered less than half correctly. Incorrect answers occurred mainly because students tried to add signals of different frequencies as phasors.

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.

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.