

ECE445 Knowledge Probe-Fall 2009

Course Coordinator: Rafael Fierro
ABET Outcomes probed: C and E.
Relevant pre- and co-requisite classes: ECE 314.

Instrument

The knowledge probe (KP) consisted of four questions which appeared on the final exam. Two questions (2 and 4) related to outcome C and two questions (3 and 5) related to outcome E. The class was taught by Professor Peter Dorato. Copies of the exam questions are attached. Acceptable performance for each question was considered to be a 75% grade or higher.

Question 2. KP(C)

This question was a test of state-space *design* techniques, in particular full-state and state-estimate feedback design.

Question 3. KP(E)

This question was a test of ability to *analyze* the stability of feedback systems, using the Lienard-Chipart stability criterion.

Question 4. KP(C)

This question was a test of ability to do tracking-error *design* for position control of a DC motor.

Question 5. KP(E)

This question was a test of ability to *analyze* closed-loop stability using the Nyquist stability criterion, and the ability to determine when a plant transfer function requires an unstable compensator for closed-loop stabilization.

Results Forty students took the final exam.

Question 2. KP(C)

75% of the students gave an acceptable answer.

Question 3. KP(E)

67% of the students gave an acceptable answer.

Question 4. KP(C)

55% of the students gave an acceptable answer.

Question 5. KP(E)

50% of the students gave an acceptable answer.

Analysis

The performance levels for questions 3, 4 and 5 were below expectations. Concerning question 4 (DC motor design), some hands-on experience with a DC motor, which was planned for but not realized, might have helped. Concerning question 5, it is likely that better knowledge of complex variable theory would help in the understanding of the Nyquist stability criterion. The performance level for Question 3 was a bit better than 4 or 5, but still below expectations. Students seem to have understood the Lienard-Chipart stability criterion, but had trouble dealing with function-inequalities required to plot stability regions.

Suggested Actions and Follow-up

- Better knowledge of complex variable theory appears to be needed. One possible solution would be to require a math course on the subject for all EE majors.
- This is the first semester that state-space design techniques have been introduced in this required control course. As noted by the results for question 2, this topic did well in the course.
- Hands-on experience for some control problems, such as a DC motor position control, should be include in future ECE445 classes.