

### General comments on EE2-6 Control Engineering paper 2013

1. The students have done very well on this question, scoring approximately 80%.
  - (a) This is an electric circuit modeling question and is a somewhat typical study group question.
    - i. Typical study group question.
    - ii. Typical study group question.
    - iii. Typical study group question, asks for a physical interpretation.
    - iv. A bit tricky since it uses all the results above.
  - (b) This is a Nyquist diagram/Routh-Hurwitz question and is mostly typical of study group questions.
    - i. Typical study group question.
    - ii. Typical study group question.
    - iii. Typical study group question.
    - iv. Typical study group question.
2. This question combines knowledge about Nyquist analysis and the Routh-Hurwitz criterion in a slightly non-standard way for compensator design. The students did less well on this question, scoring an average mark of 64%.
  - (a) Standard study group question, although part (iii) needs a little thought to deduce the phase margin.
  - (b) This uses the extended Nyquist stability criterion in that it requires the determination of closed-loop stability for all possible gains. The students tend to make elementary mistakes in signs, inversions and inequalities.
  - (c) Standard study group question.
  - (d) Standard study group question, although they haven't done PD controllers in that context.
3. This is a root-locus type design question and is a little tricky since it involve marginally stable open-loop. The students did well, scoring approximately 70%.
  - (a) Although a simple root-locus plot, some students got it wrong since the plotting rules must be interpreted correctly.
  - (b) This is standard study group question, and most students did well.
  - (c) Some students found the concept of PD controller a bit difficult to understand.
  - (d) Some students found plotting the RL of the compensated system a little difficult, perhaps because it asked for the breakaway points.
  - (e) Some students found the implementation of a controller using opamps a little difficult.