Examination Feedback for EEE6212 – Semiconductor Materials
Spring Semester 2015-16

Feedback for EEE6212 Session: 2015-2016

Feedback: Please write simple statements about how well students addressed the exam paper in general and each individual question in particular including common problems/mistakes and areas of concern in the boxes provided below. Increase row height if necessary.

General Comments:

The marks follow a Gaussian distribution, with 4 or 5 students being unable to answer at least one question sensibly while 7 students managed to get almost complete marks in at least one of the questions Q1 or Q3-5, proofing these exam questions were not too difficult. Answers to Q2 and Q6 scattered less, with many students scoring intermediate marks.
Overall, the students dealt confidently with bookwork type questions answers to which they had learned by heart but they struggled to apply their knowledge to new materials or device problems.

Question 1:

No big issues with Q1 which was attempted by all students with high confidence.
In Q1a (vi) some confused atomic number (Z from the periodic system of the elements) with number of atoms per unit cell, in Q1a (vii) many confused density (=mass/volume) with atomic number density (=number of atoms /volume) for which they received half the mark. Answers to Q1b were generally OK.
In Q1c all but two students forgot that c/8 explicitly referred only to the wurtzite-type sub-unit of which there are 3, so an additional factor of 1/3 was missing.

Question 2:

This question was not popular with the students; only 11/30 attempted it, and the average mark was low.
In Q2a, many students copied the lecture notes for cubic systems down instead of applying their knowledge to the tetragonal system. The sketches provided were often not useful, indicating a lack of 3D visualization skills. Q2b was pure reproduction but still students struggled writing down the atomic coordinates in the wurtzite unit cell. This was discussed in both lecture and tutorials.Q2c was similar to a tutorial question and answered confidently by most students. Q2d on dislocations contained two parts: the students managed to answer the bookwork part well but then could not describe the application although this had been mentioned in the tutorial.

Question 3:

This question was not popular with the students; only 11/30 attempted it, and the average mark was low.
Q3a was pure and easy bookwork but still some students confused dimensionalities. Q3b was similar to previous years and answered confidently. Q3c on MOSFETs gave mixed results: many students could draw a useful sketch but then could not explain the role of channel and gate oxide.

Question 4:

This question was rather popular, and 90% of all students attempted to answer it.
The answer to Q4a was often a 1:1 reproduction of a somewhat lengthy tutorial solution originally worked out by RA Hogg; some followed the much shorter approach I suggested in the tutorial.
For Q4b, shockingly, many students could neither write down a diode equation nor sketch a diode characteristic!
In Q4c a number of students confused type I/II band alignments with direct/indirect bandgaps.
Q4d was usually answered OK.

Question_5:

This question was not popular with the students; only 13/30 attempted to answer it.
Most could explain in Q5a what the principles of a LASER are but none could explain why this requires a system with at least 3 energy levels (although discussed in detail in a lecture). All students could answer Q5b on absorption, spontaneous emission and stimulated emission. Q5c was a complete new one and seemed to baffle the students. Only one or two actually tried to follow the instruction to integrate the exponential of the given function g(z). Nobody realized this tested their understanding of absorption of radiation as a function of absorber thickness.

Question_6:

This question was again rather popular, and 90% of all students attempted to answer it.
While most students could sketch the DOS for bulk and QD in Q6a, almost none could define what a DOS actually is. The comparison of bulk and QD produced many confused answers.
Q6b was solved confidently by most students although almost everybody forgot the part on light holes.
Q6c was an application similar to last year's exam question. The numerical solutions were obtained by many students, however, most failed to draw the appropriate conclusion from a comparison to kT.

Question_7:

Question_8: