Examination Feedback for EEE105 – Electronic Devices
Autumn Semester 2007-08

Feedback for EEE105 Session:2007-2008

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:

Overall I was quite disappointed with the results on this exam. The average on all questions was below 10 and the performance was very patchy by many students. This being said there was a significant minority of students who scored very, very poorly which skews the average to some degree. It seems that this significant minority had only a very sketchy idea of any semiconductor device and as a result basically did very poorly across the board. Quite a few students made simple arithmetic errors that lost them marks, some of which are listed below, but others included not using the correct values of constants, even though they are on the front of the exam paper.

Question 1:

a) This was meant to be easy bookwork from early in the course. I was surprised at the number of students who did not pick up most marks here. I have asked questions on this topic area in previous years, with much more solid responses on average.

b) Problem straight out of the tutorial sheets in style. Very mixed answers and not done as well as expected. Although the formula was given, it appeared that many students could not remember much about it and as a result the errors were wide and varied. Common mistakes included:
"C" being assumed as the speed of light;
Forgetting that W_g is the Ionisation Energy (or bandgap) and that it was given for Si on the front page of the exam;
Forgetting to convert the energy gap (bandgap) from eV into Joules;
The temperature not being converted to Kelvin (or not correctly);
Only changing the temperature in the $T^{3/2}$ term and not in the exponent.

c) Only a few good answers. Too many students worked the diode equation in forward bias rather than reverse bias and consequently then scored zero marks.

Question 2:

a) Bookwork, again very mixed. A photodiode is not an LED (this was a quick way to score zero marks here). The relationship between the energy of the light and the semiconductor energy gap was not commented on by as many students as expected. A photodiode also is not a photoconductor and answers about changing the resistivity of the material also were mostly irrelevant.

b) This problem again was almost a direct take out from one on the tutorial sheets. For i) I expected almost everyone to get that increasing the light four times would increase the signal four times – a majority did but… For ii) this was done fairly well by those who actually attempted it. For iii) the answer was zero as the photon energy is too low to be absorbed. Very few spotted this,

c) Quite difficult I thought, but actually done ok by those who actually attempted it.

Question 3:

Virtually everyone attempted this question which did not surprise me given that it had the highest proportion of material that was nominally bookwork. It also had the highest average of the four.

a) Bookwork from early in the course for the first part, but actually not done well. Many students forgot about polarization of a material, and insulators do NOT conduct and they are not generally semiconductors either…. As expected most students picked up the couple of marks for the material properties aspect in the second part.

b) Bookwork, generally fairly good answers, and was pleasantly surprised that most avoided the temptation to go for an n-channel answer. A significant fraction started off well and then got rather confused in their descriptions with forward biased junctions being mentioned for example.

c) A significant number of students managed to pick out the correct two equations to use and apply them with varying degrees of success. Most common mistake for those getting the working through was forgetting to take the square root in obtaining the value for d. Other mistakes included using the relative permittivity on its own rather than multiplying it by the permittivity of free space.

Question 4:

Less than half attempted this. I was not surprised given the attendance over the last couple of weeks in the lectures when this was covered. The average for this question was affected by a significant fraction of those answering it who clearly attempted it in desperation, and scored very, very poorly. (Nearly 1/6 of those attempting this question actually scored zero!)

a) Bookwork. For those who made a rational attempt many students scored fairly well on the bias conditions, description and base transport factor, although again some descriptions became more confused in places. The reasoning for why the doping in the emitter should be high was not answered well, many students gave essentially a rephrased version of the base transport factor and did not refer to avoiding electron current from base to emitter as being the problem.

b) Quite a few students identified the minority carrier diffusion length relationship as being the one to use here and scored well for the base transport factor. Very, very few students indeed got the emitter injection efficiency part, which given the answers to that part of the BJT description (the high doping of the emitter) in part a) did not surprise me.

Question 5:

Question 6:

Question 7:

Question 8: