Exam Feedback: EEE103 June 2008

General Comments: I was slightly disappointed by your efforts with this paper. It was clear that some of you had not taken the trouble to practice the skills that I warned you would be necessary for success. Once again the two main problems that some of you have are disorganisation and lack of explanation. A small number of you presented very messy work that was hard (in some cases impossible) to interpret and in a few cases you confused yourselves by failing to take an ordered approach to your questions. If you are doing an analysis, you need to draw a circuit diagram – how else can I credit correct formulation of equations describing the circuit? You need to explain briefly (three or four words is usually enough) what you are doing so that I can follow your thinking – if I just see a set of numbers or equations, you leave me in a position of having to guess whether or not you are intentionally doing the right thing. Lastly (but not least) READ THE QUESTIONS CAREFULLY. A number of marks were lost because people did not do what the question demanded and in general, those who lost marks in this way were those who desperately needed every mark they could get.

Q1: Most people scored quite well on part (i). Most of the errors here were in the polarities of V_{O1} and V_{O2}, a few of you thought you were dealing with a full wave rectifier and some thought the circuit contained smoothing. For part (ii), a small number of you worked out the average of the sum of the three waveforms instead of each average value. A few of you think the average value of a sinusoid is non-zero. Part (iii) was attempted reasonably by most - the most common error was using the "formula" for full wave and getting half the right value. Most of you knew managed to give me a sketch for part (iv) that was consistent with your answers to parts (i) and (iii) but some of you are very careless when it comes to labelling your diagrams. The biggest problem with part (v) was interpreting the question. Some thought that the Zener diode current was 25 mA although the question quite clearly says it is the "Zener diode circuit". Most of you seem to have grasped the idea of small signal diode resistance although one or two people did try and use the 6Ω r_z to calculate dc I_Z.

Q2 was a fairly standard R-C-diode question and most people successfully managed part (a) (i) to the point of identifying diode conduction state. Many people used Thevenin and Norton equivalents to simplify the problem - great to see! - but some of those people didn't do it correctly. The most common error was forgetting to modify the voltage source magnitude (by a factor of 3/(3+3) in this case). Most people got the shape of part (a) (ii) but only about half managed to identify the V at which the diode would start conducting and about half a dozen managed correctly to identify the slope in the conducting region - a clear indicator of lack of practice. One common error was to forget that the Thevenin equivalent voltage was half the actual voltage. Most people got some credit for part b (i) although about half drew the response for a low pass circuit - again lack of practice. Part b (ii) was surprisingly well done. Many of you still thought the circuit was low pass from a voltage point of view but somehow drew a correct current waveform. Of course, without the diode, both forms of RC circuit (high pass and low pass) have the same current waveform so maybe I shouldn't be surprised.

Q3: Attempts at this question were very good. Part (a) (i) was answered clearly by only a few. Most managed (a) (ii) and (a) (iii) but no one managed (a) (iv) quite properly. The key to this part is that at switch off, the current I_D is routed via D and R_S (two people understood this). The current through D and R_S immediately after switch off will be the same as I_D immediately before switch off (inductor current must be continuous if voltages remain finite). Thus the instant after switch off, the voltage across R_S and D (which can be easily worked out) adds to the supply voltage to give the required answer. There was a very similar problem in the "Transistors as Switches and Amplifiers" problem sheet. In part (b) a minority of you were able to evaluate the dc conditions of the circuit (again indicating a lack of practice on the part of the majority who couldn't). The biggest I_C calculated was 6×10^6A and the person concerned made no comment about the size of his or her answer! You should always comment on answers that look unlikely. Most people could draw a small signal equivalent circuit; only one or two people drew something so bizarre that I could find no way of awarding some marks.

Q4: Most people had a good attempt at part (a). About 20% of you had not made a serious attempt to remember the circuit shapes and about half of you failed to recognise that the question specified an ideal op-amp - ie infinite gain. You did not lose marks if you did a gain derivation with finite gain ... unless you made a mistake. A handful of people managed part b (i). The commonest mistake here - again - was to use the op-amp equation. If A_v is defined as infinite (which it was) $v^+ = v^-$ is the thing to use. People who got this far and got it wrong made a mess of calculating v+ and v- often because of unsuccessful analytical short cuts. The majority managed in part (b) (ii) to give a circuit that would realise their answer to (b) (i) in a simpler circuit form. About half of you were successful in part (c). Some people involved the dc voltages in their calculation and consequently got the wrong answer - only ac inputs give rise to ac outputs in a linear system - others simply couldn't remember (or work out) the gain expressions for inverting and non-inverting connections. Some used a $v^+ = v^-$ approach - perfectly valid - and those that went wrong here wrongly assumed that the current through the upper 3kΩ resistor was zero (true only if v^- is a virtual earth which it cant be if v^+ is non zero). Some were so muddled in their approach that they didn't stand a chance.