Exam Feedback: EEE103 June 2009

General Comments: I was quite pleased with your efforts on this paper. Although some of you had not taken the trouble to practice the skills that I warned you would be necessary for success, most people seem to have made an effort. 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 - eg, summing currents at ....) 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 and from your point of view that is a dangerous position to put yourself in. 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 managed part (i). For part (ii), very few people noted the assumptions on which their waveform sketch was based - I told you that you should always state assumptions! Rectifier questions can have a range of similar answers depending on assumptions so the rightness of your answers depends partly on whether or not you make it clear that you know what assumptions and approximations you are making. Just over half of those who attempted part (iii) used the V_{AVE} relationship for a half wave rectified sinusoid given in the useful relationships box - wrong of course for a full wave case unless you had the good sense to double the result. Part (iv), involved some derivation for full marks. Deriving a result requires the definition of a model and a statement of assumptions and approximations. A few of you provided me with excellent derivations but most of you simply scribbled down a few (correct) equations with no explanation. Most people had a decent stab at part (v) but again, very few of you told me what your thinking was - particularly in your choice of V_{INMIN}. About a third of you were not at all sure which figure to use for input voltage, many using 9V which was, of course, the output voltage. Most of you seem to have grasped the idea of small signal diode resistance.

Q2 was a fairly standard R-C-diode question and about half of you successfully managed to identify diode conduction state in part (a) (i). Many people used Thevenin and Norton equivalents to simplify the problem. Common errors were: forgetting to modify the voltage source and trying to use the 7.5kΩ resistor in both the Thevenin reduction of the voltage source/potential divider combination and current source/parallel resistor combination; you can use it in one or the other but not both. Many ignored the presence of the current source altogether! Many of you couldn't work out the net V_A - V_C created in the circuit by the two sources. 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. Most people managed part b (i) but b (ii) caused some problems. Nearly everyone got the shape correct, about 70% got the time constants but only a handful correctly identified the peak currents - especially the one following the trailing edge.

Q3: Attempts at this question were very good. Part (a) (i) was answered correctly by most. Most managed (a) (ii) and the descriptive (a) (iii) was answered reasonably well. The main problem with (a) (iii) was a failure in a few cases to relate the text to the drawing - this is vital if you want to convince me (an examiner) that you know what you are talking about. In part (b) a most of you were able to evaluate the dc conditions of the circuit. Those who had trouble here seemed to divide arbitrary voltages (often with 0.7V added or subtracted) with resistances picked at random from the circuit. Most people could draw a small signal equivalent circuit and then use it to estimate the small signal gain.

Q4: Most people had a good attempt at part (a). The main failings lay in the "explain briefly" bit of the answers. A few hints for the future: decide what key ideas you need to mention; decide what order they should be in; write them as concisely as possible taking care to refer to components or parameters using the same symbolism as you used on your diagram; refer to your circuit diagram in your explanatory text (a few people left me to work out where the virtual ground node was). The majority of people managed part b (i). It could be done by superposition or equating v^+ and v^-, the latter being fairly trouble free. A number of people ran into trouble with superposition. Using superposition,

$V_O\big|_{V_1} = -V_1\dfrac{R_2}{R_1}$ and $V_O\big|_{V_2} = V_2.\dfrac{R_2}{R_1+R_2}.\dfrac{R_1+R_2}{R_1} = V_2\dfrac{R_2}{R_1}$. $V_O\big|_{V_1}$ and $V_O\big|_{V_2}$ should be summed and the result is obvious.

Some people rearranged to get V_1 and V_2 in terms of $V_O\big|_{V_1}$ and $V_O\big|_{V_2}$ and subtracted, treating them as equal (and equal to V_O). A few moment's thought will tell you that this cannot in general be correct. Most had at least some success in part (c). Some used superposition but 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 made the mistake of treating v^- as if it was a virtual earth node. As soon as v^+ is non-zero there will in general be a current flowing in all the resistances connected to the v^- node so the current sum at v^- should have three terms for both the ac and dc calculation. v^+ was given. As usual, some were so muddled in their approach that they didn't stand a chance.