Exam Feedback: EE103 June 2010

General Comments: I was disappointed by your efforts on this paper. Although some of you had taken the trouble to practice the skills that I warned you would be necessary for success, too many people seem to have made a minimal effort. Once again the two main problems were 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 many 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) 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 - READ THE QUESTIONS CAREFULLY.

Q1: Answers to part (i) were mixed. About a third of you sketched the wrong polarity and most of you ignored the last bit. For part (ii), the majority of you noted the assumptions used in calculating C (good!) but some of you used the formulae for a full wave rectifier instead of starting from first principles as advised. There was a reasonable attempt at part (iii) although a depressingly large minority neglected the Zener diode in their calculation. Most remembered how to do part (iv) but part (v) was a disaster. The commonest erroneous answer was (Zener voltage)^2 divided by R. What were you thinking of? - the Zener diode voltage is not the voltage across R. Most who made this error didn't bother to draw a circuit diagram - an omission that puts great strain on your mental processes and evidently too much strain in many cases.

Q2 was a fairly standard R-C-diode question and about half of you successfully managed to identify value of V needed to put the diode on the point of conduction. The commonest problems experienced by those who came unstuck were sloppy analysis (not drawing a circuit diagram and being careless with conventions) and defining the wrong direction for the voltage drop across the forward biassed diode even though I indicated V_D on the diagram. Part (iii) caused some problems - most people sketched I_D v V (instead of I_R v V) - lack of care in reading the question the culprit here. In part (b)(i) a handful noticed that the aiming level of the output in response to the input was 6V - most wrongly treated it as 10V. You suggested quite a wide variety of time constants and peak currents but few of the suggestions were correct.

Q3: Attempts at this question were better than those at Q1 and Q2. Part (a) (i) was answered correctly by most, although some felt (wrongly) that $V_{GS\ ON}$ should be subtracted from the supply before dividing by R_L. 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. Part b(ii) was not done well. Capacitors were added in the most unlikely of places and that betrayed a lack of understanding of the bias circuit and the way the circuit interacted with signals. Some people could draw the small signal equivalent circuit requested in part (iv).

Q4: This question produced the best of the answers and this was despite (or perhaps because of) my spending only one and a half lectures on the topic of op-amps. Most people had a good attempt at part (a). The main failings lay in the choice of resistors - some of you chose very small values like 10Ω and 1Ω - the amplifier would not work with such low values. Most people had a good attempt at a(ii), one or two people remembered the perfect answer for the non-inverting circuit and got little credit. The biggest algebraic problem seemed to be the idea of getting v_o terms on one side of the equation and v_i on the other. Parts b(i) to b(iv) were similar in nature and were asking for a circuit to be drawn for each case. Those who did this generally managed to get to the right answers. Those who didn't fell into two camps; those who were very comfortable with op-amps and could work just with figure 4b and those who were writing down equations in the hope that one of them might be correct. A number of people ran into trouble with V_1 and V_2 and the potential division leading to v^+, for example $V_O\big|_{V_2} = V_2 . \frac{R_1}{R_1 + R_2} . \frac{R_F + R_3 // R_4}{R_3 // R_4}$ is the appropriate for V_2. Some people used the answers to parts (i) to (iv) as a starting point for part (v) whilst others started a new analysis. Generally part (v) was done well - the biggest source of error was people ignoring the signs of the gain terms (parts b(i) and (ii) have positive answers but parts b(iii) and b(iv) are negative). This problem was exacerbated by a badly organised and muddled answer where candidates tended to confuse themselves by their untidiness.