# Exam Feedback: EEE103 June 2011

**General Comments**: I was quite pleased by your efforts on this paper. Many of you had taken the trouble to practice the skills that I warned you would be necessary for success although a handful of people had quite obviously made no effort to pass the exam. The two main problems that lost marks were disorganisation and lack of explanation. As was the case last year, 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. Many marks were lost because of reluctance to keep the kΩ unit with resistors - 1.5 kΩ written as 1.5, for example - and getting currents of A instead of mA. 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:** Most of you managed parts (i), (ii) and (iii). Part (iv) was where the trouble began. Firstly, parts (a) and (b) are best worked out in the order (b) then (a) since the answer to (a) involves the answer to (b) whereas the answer to (b) is not dependent on (a). Secondly, the 100W is the full power amplifier output; the supply power needed to sustain that level of amplifier output power is considerably greater than 100W - valve guitar amplifiers, like most other amplifiers, are not very efficient. The most common error in the calculation of ripple was to forget to double $f_{in}$ because it is a full wave circuit - instead of 50Hz you should have been using the ripple frequency of twice that value. Many of you said $P=VI$ so from 100W and 350mA one can deduce a $V$. This approach is meaningless because the 350mA is not directly related to the 100W; it gives a value smaller than $V_P$ - $V_R$, even when the $V_R$ was calculated for a ripple frequency of 50 Hz. The answer should, of course, have been $V_P$ - $V_R/2$. There was a reasonable attempt at part (v); the most common error was failing to use the minimum $V_{in}$ ( = $V_P$ - $V_R$). If people used the $V_P$ from an erroneous part (iv)(a) but everything else was OK they got the marks. In part (vi), most people got the ripple potential divider but there was some confusion about what the input should be; $V_R$ of course. Lastly, part (vii) was a bit of a mess. For normal operating conditions you can't use the minimum $V_{in}$ conditions that had to be used to find the maximum $R$, normal (average) conditions must be used. So $V_{in} = V_P - V_R/2$ and $I_R$ will be bigger than the 6mA used to find $R$. The increase in $I_R$ will flow through the Zener diode (because $I_L$ remains constant). $P_{DZ} = 200\ I_Z$ and $P_R = (V_P - V_R/2 - 200)^2/R$. $P_{DZ} = 200^2/r_Z$ is wrong - dc power cannot be dissipated in an incremental resistance.

**Q2** was a fairly standard *R*-*C*-diode question. Most managed part (i). In part (ii) marks were lost by people not doing what was asked: find $I_D$ and $V_D$ ... . Some assumed I knew the voltage across a conducting diode - but it's not me who is being tested! As ever, the commonest problems experienced by those who came unstuck were sloppy analysis and defining the wrong direction for the voltage drop across the forward biased diode even though I indicated $V_D$ on the diagram - the arrowhead is the plus end. Part (iii) was done well by most although some used the wrong axes - lack of care in reading the question the culprit here. In part (b)(i) most did a good job, in b(ii) about half had trouble with the peak current on the trailing edge and in part (iii) aiming level and $\tau$ were modified. About half did it OK, some noticed aiming level change, some the $\tau$ change, some got the $\tau$ change wrong and there was a small but creative set of new ideas for exponential shapes - all wrong I fear.

**Q3:** Attempts at this question were reasonable. Part (a) (i), (ii) and (iii) was answered correctly by most. Part (iv) was varied; those who remembered that $L$ wants to maintain continuity of current and that $I_C$=0 when the switch is off managed it. Most erroneous answers could have been sorted out by application of KCL at the collector node. Part b(i) was attempted reasonably - only one person, though, remembered that to make $I_B$ negligible $V_{CC}/(R_1 + R_2) = 10\ I_B$. In part b(ii), capacitors appeared in a range of different and surprising positions - about half were OK.

**Q4:** Again 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. Parts (i), (ii) and (iii) were generally well done with most lost marks going in part (ii) caused by people not giving me values in response to "suggest suitable values". Not many of you managed the input resistance - odd after the virtual earth question; the virtual earth means that the source sees a resistor $R_1$ with its other end connected (as far as the external world is concerned) to ground. Part (b) was answered well in most cases. The problems that there were centred around poor organisation - ie, messy work typically with multiple crossings out that hadn't been followed through quite properly - and the perennial not bothering to put kΩ after resistor values, a lazy and undesirable habit. The parallel combination of $R_1$ and $R_2$ was 1kΩ and it was common to find statements like "$V_O$ due to $V_1 = V_1\ (R_F + R_1//R_2)/(R_1//R_2) = (R_F + 1)$" and then to find that the writer had forgotten the implicit multiplier. You really should avoid this shorthand. If you can't resist it, keep everything symbolic until the very last step.