# Exam Feedback: EEE204 January 2010

**General Comments**: Once again, these are not significantly different from last year. A reasonable attempt at EEE204 very few people scored very low marks. As last year, and, sadly, every year, many marks were lost because of silly numerical errors and whilst each error only loses one mark, some of you were totting up quite a few that you could ill afford. The two main problems that some of you have are disorganisation and explanation. These are perennial problems so the comments that follow were also in last year's feedback comments. Some 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.

**Q1:** In part a(i) about 90% of you thought that since the reactance of *C* approached zero at high frequencies, the lf gain would also approach zero. One or two of you actually drew out the circuit with the capacitor replaced by an open circuit (ie, $v_o = v_i$) and *still* said lf gain = zero! Most of you recognised that hf gain was a resistive potential divider and most of you (in part (ii)) managed to derive the transfer function of figure 1. In part (a)(iii) I got a range of sketch shapes. If the shape was consistent with the answer to (a)(i), I gave the marks. Some people drew a frequency response . . . and got no marks - read the question. In part b(i) most of you found the bandwidth although some of you forgot that if GBP has units of Hz the BW calculated from it is also in Hz. I was disappointed by your attempts at (b) (ii), about 15% got this one correct! The biggest problem was an inability to work out the modulus of a complex number - get a grip, year 2! The most common error in part (iii) was to assume that "triangular waveform" was a misprint "for sinusoidal waveform" - an assumption that got no marks. The key was to draw a sketch of a triangular waveform - working out dV/dt in terms of triangle wave periodic time is then trivial.

**Q2.** There was a wide range of answers to part (i). The main pass-band features were ripple for Chebychev (C) and flat for Butterworth (B), cut off rate faster for C than for B, B popular because relatively insensitive to component tolerance errors. Most of you got somewhere close with the Sallen and Key circuit shape although a few used two op-amps and several resistors despite the question insisting on two *R*s, two *C*s and one op-amp. Most of you managed to extract the key parameters in part (iii). Those that didn't went wrong with *q* factor usually by getting $\omega_n$ the wrong way up (I warned you about this in the lectures). Part (iv) produced some interesting responses. One common error was to start by multiplying out the denominator of the transfer function to get a third order expression - this simply complicates matters and makes it virtually impossible to identify the required parameters. Only one person correctly dealt with the 20kHz cut-off frequency requirement; most of you simply ignored it. For part (v) you got the marks if your result was consistent with the *q* factor expression obtained from part (iii) and the value of *q* obtained from part (iv). One or two of you assumed a value of *q* - I gave you the marks.

**Q3:** This question was attempted reasonably well – most of you managed the first two parts without problems. Those who had problems made mistakes like forgetting to square the potential dividers operating on the various noise power sources. There were the usual careless errors caused by saying $R_1//R_2 = 0.8$, forgetting the kΩ unit that should have been there. It's always dangerous to strip the kΩ from the number. In part (b) most people managed to define noise factor but there were some very creative attempts to include NA - about one third of you got it all correct. Most of you got somewhere in part (c). The biggest single problem was in the working out of signal to noise ratio - 90% of you treated it as a voltage ratio when it should be a power ratio. Thus quite a few answers were the square root of the correct answer.

**Q4:** Attempts at question 4 were for the most part reasonable. Answers to part (i) were mixed - some people were brief and to the point whilst others wrote in excess of a page of material only partly related to the question. Most people had a good go at 4(b)(i). The commonest mistake was to forget that two power supplies contribute to $P_{IN}$ and this leads to an incorrect condition for maximum power dissipation. A significant fraction of those making this mistake miraculously managed to get the right answer, a feat not possible without the accidental (or deliberate) introduction of a second error. You lose one mark per error so allowing a second error to creep in so as to get the answer required is a risky strategy. Part (b)(ii) was attempted well by most; the two most common errors were (1) forgetting to divide $V_P^2$ by 2 to get the power dissipated by the sinusoidal drive and (2) using the result of (b)(i) which is, of course, power dissipated and not load power. Part (b)(iii) was answered well as was part (b)(iv). I was pleased with your answers to part (b)(iv) - I taught the heat sinking bit this year slightly differently from last year and the approach to solving a problem that has two independent limiting conditions seemed much more widely understood by you than it has been in previous years.