Exam Feedback: EEE204 January 2009

General Comments: 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 hf gain would also approach zero. One or two of you actually drew out the circuit with the capacitor replaced by a short circuit (ie, $v_o = v_i$) and *still* said hf gain = zero! Most of you recognised that lf gain was a resistive potential divider and most of you (in part (ii)) managed to derive the transfer function of figure 1. In part (iii) I got a range of sketch shapes - about 10% of them were right. Interestingly, some people correctly deduced hf gain from the transfer function but didn't correct their wrong answer to part (i)! In part (iv) you either had to say lf gain (resistive divider) must equal hf gain (capacitive divider) or recognise that $C_1R = C_2R_1$ to remove frequency dependence from the circuit gain. Alternatively you could re-analyse the circuit with the extra component and find the condition that made pole and zero cancel out - a laborious alternative just for 2 marks. In part b(i) about half of you thought two amplifiers of linear gain "A" connected in series had a gain of (A + A) - it is of course (A x A). I was disappointed by your attempts at (b) (ii); you can use gain-bandwidth product to find the bandwidth of each amplifier but you cannot divide the GBP of each amplifier by the total gain of the cascade. About 10% got this one correct! The most common error in part (iii) was to interpret 70V μs^{-1} as 70 x 10^{-6} V s^{-1} - very disturbing, it is in fact 70 x 10^{6} V μs^{-1} - and the next most common problem was to forget to divide the ω in the maximum rate of change of a sinusoid by 2π to get frequency in Hz.

Q2. Most people had a reasonable go at part (i). Those who went wrong nearly always went wrong at the initial current summing step. Part (ii) tested your ability to identify the major features of the transfer function given, most attempts were reasonable although a few people thought it was a band pass response (which it wasn't) and some thought it was digital! Part (iii) asked you to interpret the transfer function given to identify k, ω_n and q - generally done well. Most people who made errors got the q wrong usually because of algebraic errors in the substitution of ω_n into $1/(\omega_n q) = (2C_2 - C_1)R$ caused by trying to do too much in one step. Most people managed part (iv) without difficulty. The two common errors were saying "damping term ≥ 1 for stability" (should be ≥ 0) and writing the inequality the wrong way round.

Q3: This question was attempted reasonably well – 30% 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. An alarmingly common error lay in the working out of 3kΩ in parallel with 2kΩ - many got an answer 1.2 but forgot about the kΩ ... very careless. It's always dangerous to strip the kΩ from the number. About half of you realised that you needed to find the noise temperature of R_{Th} in order to use the kT/C relationship. In part (b) most people managed to define signal to noise ratio and noise factor but only a handful identified the key aspect of noise factor that made it useless as a measure of signal quality - the noise factor is independent of signal; it depends only on the system. Your response to part (c) was disappointing. Most people produced uncommented equations written in a disorganised way so that it was difficult to deduce whether or not you knew what to do with bandwidth. If I couldn't make sense of what you had written, you didn't get many marks.

Q4: A relatively small fraction of you attempted question 4 but most of you that did attempt it made good attempts. Most answers to part a(i) got full marks although some people lost a mark because they failed to label amplitudes as requested. In part a(ii) the biggest cause of error was putting one or both batteries into the circuit the wrong way round and a(iii) there were some creative (but wrong) ideas about where to put the resistors. In the parts that involved the writing of circuit diagrams some of you missed off the emitter arrows from the transistor symbols. This instantly introduces ambiguity into answers and hence causes mark loss. In part b(i), a few people realised that it was necessary to work out whether the maximum voltage capability or the maximum capability was the limiting factor in terms of power output – in this case current was the limiting factor and $P_{MAX} = I_{MAX}^2R/2$. Part b(ii) was done well by most people – errors were usuall traceable to incorrect reading of the question. Thermal questions are often long because there are so many parameters to define so you must read them carefully.