# Exam Feedback: EEE101 January 2011

**General Comments**: Once again your attempts at EEE101 were mixed and slightly disappointing. Although there were some excellent efforts there were too many of you who had been trying to learn processes without thinking too hard about the underlying principles; identifying and understanding underlying principles is a crucial part of your learning with us. It is a surprise year on year to me how many of you aren't quite confident with ideas like Ohm's law - you've got to grasp the ideas, play with them, turn them upside down and look at them from different perspectives. Then you will start to use the idea with more confidence. Quite a few marks were lost, as usual, because of silly numerical errors that could easily have been checked and quite a few more marks were lost because the answers given were not in line with the questions asked. **It is really important that you read each question properly and make sure you do everything it asks of you.** Some of you are very organised; it is easy to follow your working and, where your answer is wrong, identify your error and give you appropriate credit for what you have done. Some of you, on the other hand, presented very messy work that was hard (in some cases impossible) to interpret and in a few cases you confused even 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 - not wise if you want marks from me. Try to do quick checks on your answers - in dc circuits these take about 15 seconds and can easily identify errors and answers that don't make physical sense (eg, voltage across a resistor bigger than the voltage of the driving source).

**Q1:** Question 1 was answered pretty well by about half of you. In part (i) the biggest problem that you had was the definition of a node. Many people seem to confuse junction points and nodes. Node A consists of the top of the 1.5Ω resistor, the top of the 3Ω resistor, the top of the 2A current source and the left hand side of the 2Ω resistor. The node involves two junction points merely for convenience of drawing. The next big problem was a failure by many to draw a clear circuit diagram and mark clearly on that diagram the directions chosen for the resistor currents. Remaining errors were convention errors in writing down the currents in terms of voltage difference and resistance and some people think that current sources push current in the opposite direction to that indicated by the arrow. Most people managed the power - which you got credit for even if the answer for $V_A$ was wrong. Most of the errors in part (b) (i) arose because people didn't define a consistent reference node - ie, one that remained the same for all the superposition partial circuits. Very few managed (b) (ii). Most people determined the effective resistance driven by each source and then used V2/R to get the answer. That tells you the power delivered to that effective resistance by that source alone, it does not tell you the power delivered by the source in the full circuit. The current source power is simply 2A x $V_A$. The other powers must be worked out by multiplying source voltage and total current - eg P(5V) = 5 x ($V_A$–(–5))/2Ω.

**Q2.** The response to part (a) was very disappointing. To find the Thevenin equivalent resistance, replace the current source with its equivalent impedance (open circuit or infinite resistance), look into terminals A and B and ask yourself what is the effective resistance between those terminals. Simple! $V_{Th}$ was more of a challenge that demanded that you identify a reference node that other voltages, $V_A$ and $V_B$ in particular, could be measured with respect to. When working out $V_A$ - $V_B$, the reference disappears. Part (b) was very similar to a class example. By calculating the dc voltages and currents in the circuit the voltage across $C$ and current through $L$ could be calculated and so the stored energies could also be calculated. Part (c) was one of those immediately before and immediately after problems. Initially (ie, at $t = 0^-$) a dc problem with an input of -10V gave $V_C = -5$, $V_L = 0$ and $I = -10\text{V}/100\Omega = -0.1\text{A}$. In part (c) (ii) the governing rules are: you can't change the voltage across $C$ in zero time and you can't change the current through $L$ in zero time. This led to $I = -0.1\text{A}$ and $V_C = -5\text{V}$ (same as at $t = 0^-$) but $V_L$ ***can*** change. Since $I$ is unchanged at $t = 0^+$, the potential at the top of $V_I$ is 10V below that at the top of $L$ and this 10V is added to the $V_i$ caused by the pulse giving a $t = 0^+$ value of 30V.

**Q3:** This was probably the most successfully attempted question. In part (a)(i) most of you who recognised that the circuit was a potential divider between $L$ and the parallel $CR$ combination managed to get to the required answer. Some, after a page or so of incorrect working, finished with "= [required result]". I do check that the result is consistent with what precedes it! A problem that I've never seen before surfaced several times; after correctly writing $Z = X_L + R//X_C$, some proceeded to work out $(X_L + R)//X_C$. Clearly the former is correct but the problem does suggest that some of you would benefit from putting brackets around parallel combinations. Most of the errors in part (a) (ii) were caused by errors in the complex arithmetic involved - no cure here other than take care - although one or two put $j$ terms to zero and tried (without success) to work with what was left of the impedance. Most had a good attempt at (b) (i). The most common problem was making an error in calculating $Z$, which in turn was caused by errors in trying to work out the parallel combination of $j10$ and $-j5$. (This should have been $j10//(-j5) = -j^2 50/(j10 + (-j5)) = 50/j5 = -j10$.) The errors were usually associated with the many minus signs involved - needs sturdy and methodical thinking. If you got $Z$ wrong, you still got marks for $I$ and $V_1$ providing that your numbers were consistent with your incorrect $Z$. In the last part where the capacitor was changed for one with reactance $-j10$, $j10//-j10$ turned out to be infinite. Some of you realised what this meant but only one or two got the right answer which was $I = 0$ (most got this) therefore $V_1 = V_S$ (only a handful got this).

**Q4:** Attempts at question 4 were reasonable. Most people identified correctly one of the two low pass circuits and a number thought low pass was always $LR$ - not true. Part b (i) was pretty well answered although some people thought that a reactance of $-j15.9$ was equal to $j\omega C$. In fact it is equal to $1/(j\omega C)$. Quite a few realised that the extra inductance would make the system into a series resonant circuit leaving just $Z = R = 10\Omega$. Calculation of power was then straightforward. A significant minority of people used the given current when the extra inductance was added to the circuit - this of course is wrong; if one changes the impedance across a voltage source, the current will change.