Examination Feedback for EEE218 – Electric Circuits
Autumn Semester 2015-16

Feedback for EEE218 Session: 2015-2016

General Comments:

The exam counts for 80% of the overall module marks, with 2 lab classes making up the remaining 20%. For the first time this year the labs have been entirely run and assessed by staff within the Diamond.

Most candidates attempted the required 3 questions, but a handful answered a 4th (additional questions were not marked) – ***you should always read the rubric on the front cover of the exam to find out the number of questions that you need to answer.*** About 40% of candidates failed to fill in the numbers of the questions answered on the front cover of the answerbook – this puts the marker in a bad mood and they are less likely to be lenient! Some scripts were extremely untidy and difficult to read and more detailed explanations need to be given.

Question 1:

Attempted by about 73% of candidates. Generally this question was well attempted with several candidates achieving full marks. In part (a)(i) a common problem appeared to be candidates misreading/interpreting the formula for reluctance on the equation sheet. The numerator is a small letter '*l*' (representing length and not the number '1'; this should be obvious from your knowledge of magnetic circuits and also from the rubric immediately below the equation. In part (a)(ii) some candidates confused flux and flux density. Most candidates attempted part (a)(iii) without difficulty. Part (b)(i) posed more problems; the magnetic circuit is now the sum of the core reluctance (albeit with a slightly reduced length) and the airgap reluctance – some candidates ignored the airgap reluctance or assumed it had the same relative permeability as the core, some assumed the core reluctance from part (a)(i) (although this only reduces a slight error) and some ignored the core reluctance all together. Again part (b)(ii) presented little problem. The main problem in part (c) was candidates assuming the flux density/flux from part (a). It is now connected to a different supply (10V) so the current and hence flux will change. Also several candidates saw the word 'peak' and immediately multiplied their answer by $\sqrt{2}$; this is only valid for converting rms to peak values in sinusoidal AC systems – this is DC! Most candidates made a good attempt at part (d) in its entirety. The main problems were inverting the turns ratio (this question is a step-up transformer, whereas most previous examples have been step-down). In part (d)(ii) several candidates ignores the '*j*' operator when determining the impedance of the circuit. The annual reoccurring problem with confusing power and VA presented itself in parts (ii) and (iii). Most candidates successfully answered parts (d)(iv) and (v).

Question 2:

Attempted by about 86% of candidates. Most candidates made a good attempt at this question although part (b) presented more of a challenge. Many candidates lost marks as they failed to fully read what was required and skipped parts or showed insufficient explanation and intermediate steps. Part (a)(i) did not present too many problems, although many candidates omitted to state the condition for resonance is when the imaginary term equals zero. Generally parts (a)(ii) and (iii) did not present to many problems, however in part (iv) many candidates lost marks for not showing sufficient steps to explain their working. Another common mistake was to leave the expression for Q in terms of the resonant frequency rather than substituting for this to get an expression just containing the circuit parameters, R, L and C. Most candidates correctly answered part (v) although some made basic algebraic and mathematical errors. In part (b)(i) many candidates started by writing down the incorrect expression for the impedance but somehow managed to obtain the correct answer (given on question paper) a few lines lower – inevitably accompanied by much crossing out and difficult to read intermediate steps! No marks were awarded for this. In part (b)(ii) many candidates made the mistake of setting Z=R – this is only true for an ideal series or ideal parallel circuit which is not what we have here. Another common error was to consider only the imaginary terms in the numerator before eliminating all the imaginary terms in the denominator. The condition for resonance in all circuits is that the imaginary terms sum to zero.

Question 3:

Attempted by about 91% of candidates. The majority of students made a good attempt at this question, apart from the very last part which only a few answered correctly. Part (a) was fairly straightforward although some students confused the initial value of R at 15°C with $R_{0.}$ Most students correctly answered part (b)(i) but in part (b)(ii) some either forgot to calculate the power in the heater or calculated the total power instead. Part (b)(iv) is slightly more involved since when the cross-sectional area of the conductors change then the overall circuit resistance and hence the current will change. Use the voltage across the heater and its resistance to find the current. In parts (c)(i), (ii) and (iii) there was the usual confusion between real power (W), reactive power (VAR) and Volt-Amps (VA), however it was part (c)(iv) that caused the most problems. Firstly the capacitor for power-factor correction is always place in parallel with the load (most students assumed it was in series) and there was the added confusion as the power-factor was to be corrected to 0.98 and not unity. Many students started from the value of VA calculated in part (c)(ii) but this will change when the capacitor is added. Others simply multiplied the KVAR value by 0.98 and used that; both these methods give incorrect answers. The only quantity that will remain the same is the real power. Some students used a novel method using the impedance of the circuit (which is actually the formula given in question 2). They realized that the imaginary part of this divided by the real part would give the tangent of the phase angle.

Question 4:

Attempted by about 50% of candidates. The majority of candidates successfully solved part (a) correctly using superposition. A very small number had difficulty identifying which pairs of resistors were in parallel, made numerical errors, or omitted to indicate the direction of current. In part (b) it is necessary to obtain one equivalent resistance which will allow the voltage across it, and hence its component resistances to be calculated. Some candidates combined two of the resistors and then used the proportion rule to find the current in each resultant resistor. This works provided the 7 and 8 Ohm resistors are combined if the current in the 4 Ohm resistor is required. In part (c) students still misunderstand the Thevenin voltage; it is the open circuit voltage across the terminals of the original network. Also indicating the direction of the voltage is important – several students showed this inverted (as was the case in a previous exam question) which led to mistakes in part (d). In part (e) some student again showed the current source inverted.