Examination Feedback for:
EEE338 – Power Engineering – see questions A1–A4 and B1–B4
EEE341 – Electrical Power Systems – see questions A1–A4
EEE301 – Power Systems Engineering – see questions B1–B4
Spring Semester 2013-14

Feedback for EEE338 / EEE341 / EEE301 Session: 2013-2014

General Comments:

The main problem in this exam was students failing to show sufficient working and intermediate steps meaning it was difficult to award part marks if the final answer was incorrect. This is particularly important with diagrams. There were also a number of problems associated with conversion from complex to polar form and vice-versa (see comments under Q3 below). It is worth spending a few pounds and getting a calculator that can handle this correctly and also save you time in performing the calculations.
Several candidates achieved very high marks, but there were a similar number who failed to make the pass mark and it is quite clear that the latter did not spend anywhere near enough time on independent study and practice. You should be spending about 5 hours per module per week outside lectures and then bringing you problems to the tutorial classes, which incidentally were very poorly attended.
Some candidates only answered 4 rather than 5 questions – it is not clear whether they ran out of time or failed to read the instructions on the front page. Quite a few candidates failed to complete the front cover indicating which questions had been attempted – this puts the marker in a bad mood as they have to go through the script to check. A marker in a bad mood may not be as generous in their giving of marks!

Question A1:

Attempted by just under 30% of candidates. Most candidates attempted part (a) but few gained full marks as often they answered the part about the infinite busbar but omitted the second part about synchronization. The variation in the quality of answers for part (b) was dramatic. A few candidates clearly understood the operation of the machine and gave model answers, but the large majority clearly had no real understanding and simply tried to reproduce the answer from a similar question on a previous exam, generally with little success. The question clearly requests phasor diagrams so do not omit these!
The main confusion in part (c) was between S, P and Q and between the factory values, motor values and total values. In part (c) (iii) the main error was using the value for the total power rather than the per phase value.

Question A2:

Attempted by about 75% of candidates. Most candidates gave a reasonable answer to part (a), however very few candidates scored full marks for part (b). Diagrams were poor or nonexistent; sometimes candidates drew diagrams of busbar, tie-bar, generator and feeder reactors but did not label them, which means the diagram is rather pointless. Only a few candidates even bothered to mention sectionalized connections or HVDC. The majority of candidates made a good attempt at part (c)(i) although some rounded values too much and some omitted to notice that the busbar reactance value was given in Ohms. Only a very few candidates successfully managed part (c)(ii); you need to proportion the current coming from Busbar A and G2/G3 and then halve it since G2 and G3 have the same per-unit impedance. The main problem in part (c)(iii) was that candidates correctly identified that a fault on the busbars would lead to the highest fault currents, and correctly calculated these currents, but did not work out the current through the reactor.

Question A3:

Attempted by about 90% of candidates. Part (a) was reasonably well attempted but there were a lot of calculation errors. One common problem was conversion from complex to polar format; some calculators appear to be unable to distinguish between (a - jb) and (-a + jb) (in both cases the angle would be arctan(-b/a) but in the first case the angle would be in the 4th quadrant (between 0 and -90 degrees) and in the second case it would be in the 2nd quadrant (between 90 and 180 degrees). Either take great care to check this or, as I recommended several time during lecture, make a small investment in a calculator that can handle this problem. Several candidates showed insufficient intermediate steps in the calculation which made it difficult to award part marks if the final answer was incorrect.
In part (b) many candidates omitted the line voltages from the phasor diagram and the quality of many diagrams was very poor, in some case virtually illegible. In part (c)(i) most candidates correctly identified that the voltage coil should be connected to phase B rather than A then the voltage it measures is V_{CB} (not V_{BC}) this caused many errors in calculating the power in part (c)(ii). Many candidates omitted part (c)(iii) entirely or simply quoted Yes or No without very much explanation.

Question A4:

Attempted by about 90% of candidates. Part (a) was bookwork and several candidates just omitted this. If you understand the fundamental differences between induction and synchronous machines this would have been easy marks. Similar comments apply to part (b). The majority of candidates made a good attempt at part (c)(i). The load resistance should be negative (as it represents power into the system) and if it wasn't then this should have alerted you to an error. Most candidates correctly calculated the magnitude of the magnetizing current, but several then used the incorrect sign for the imaginary part (22.7 – j97.7). The minus sign indicates the current is lagging which should be apparent as we are dealing with an inductive reactance. Another common error was to omit the complex conjugate in $S = 3\ V_{ph}\ I_{ph}^{*}$ This should give a negative value for the real power (as it is a generator) and a positive value for the reactive power (one of the drawbacks of induction generator is they draw VARs). Again there were some calculator problems associated with conversion from complex to polar form (see comments under Q3). Errors associated with part (c)(ii) included forgetting the factor 3 (total power required) and using the total current rather than the current flowing through the load branch. Part (c)(iii) did not cause many problems, however the same cannot be said for part (iv). You cannot use the value of S calculated in part (iii) as this will change when the capacitors are added. The addition of the capacitors will not affect the real power, P, so this in conjunction with the angle from the power-factor can be used to find the final value of Q from which the contribution to Q from the capacitors can be found. Part (v) did not present many problems.

Question B1:

Attempted by about 20% of candidates. Most candidates omitted part (a) completely. During lectures it was stressed that students should be able to deduce the formulas for inductance. For part (b)(i) the formula is given in the question and all that was required was to substitute numbers; despite this most candidates managed to make mistakes. Part (b)(ii) was a little more difficult as it required candidates to calculate the GMR. The conductor layout was fairly straightforward, but candidates got mixed up with when to use the radius, r, and when to use the effective radius, r'. Part (c) was reasonably well attempted, but several candidates incorrectly calculated the current by forgetting the power-factor when deriving current from real power. Most candidates gave a reasonable answer to part (d).

Question B2:

Attempted by about 40% of candidates. Parts (a), (b) and (c) were purely descriptive and most candidates made a reasonable attempt at this, although in many cases answers were rather brief. If you use a diagram to illustrate a point then make sure it is legible and labeled. There was a mix of abilities shown for part (d) with some candidates clearly knowing the correct method, however some candidates produced answers with lots of scribblings and crossings out and amazingly quoted the correct final answer despite have written down the initial equation incorrectly! This doe not gain you any marks. One of the main problems in part (e) was that students only did the calculations for the +10% tap and omitted the nominal tap. Only 2 candidates correctly managed part (e); most forgot about the 1.0 pu impedance of the grid infeed or forgot to convert this to the 100MVA base of the transformer (0.1pu).

Question B3:

Attempted by about 50% of candidates. Only a few candidates bothered to attempt part (a) and several of those drew the curve for a generator or claimed the rotor sped up as an increased load was applied. Parts (b)(i),(ii) and (iii) were answered well, but the quality of sketches was poor as was the labeling – even non-existent in some cases. There also was confusion between the switching angle, critical clearance angle and the critical load angle. Only 3 candidates managed to obtain the correct answer for part (v) most made calculation errors or mixed up when to use degrees and radians. Most candidates omitted part (c) which was bookwork.

Question B4:

Attempted by just over 80% of candidates. Most students coped with part (a) well, although a few omitted to account for the voltage mismatch on Generator G and a few forgot to convert the line Ohmic values to pu quantities. In part (b) some students struggled with the positive and negative sequence networks – you need the impedance from the source to point of fault (i.e. The Gen G / Trans F branch is in parallel with the Gen A / Trans B / Line D / Trans C / Line E branch). The zero sequence diagram caused even more problems. Again without labeling the diagram it is impossible to award any part marks. Only a handful of candidates even attempted part (c). Of those that did many assumed Z_+, Z_- and Z_0 were in series – this is true for a single phase to earth fault (which has been on the previous years exams, but this is a 2-phase to earth fault. For part (d) Gen A plays no part in the zero sequence diagram so adding an earthing reactor here will have no effect.