Examination Feedback for EEE345/6084 – Applied electromagnetics
Spring Semester 2012-13

Feedback for EEE345/6084 Session: 2012-2013

General Comments:

The students found this quite a hard paper, though some were able to provide excellent answers. Q3 was the least popular question, but yielded the highest average mark.

Question 1

a) 1d wave equation for current flowing in lossless transmission line. Straight forward bookwork. Generally well done.

b) i) Propagation constant for lossy transmission line. Some students forgot to include *both* resistive components (R and G). Some students pulled answer out of thin air, without any attempt at derivation.

b) ii) Sketch of time dependence of sine wave 100 m along lossy transmission line. In general, not well answered. Many students showed situation as a function of *x* (i.e. position) rather than *t* (i.e. time). Only a few correctly calculated the peak voltage at x = 100 m (4.5 V).

b) iii) Sketch of time dependence of square pulse 100 m along lossy transmission line. Ditto b) ii). Only a few students correctly showed the pulse dispersion.

c) Suitable materials for microstrip transmission line. There was no expectation that the students would know the actual materials that are usually used (copper and PCB), so full marks were awarded for any combination of metal (conductor) / dielectric / metal. Full marks were awarded for all sensible dimensions (µm – mm range).

d) Voltage at load on lossy transmission line. Lots of students simply worked out value for reflection coefficient (Γ), rather than amplitude at load, see below.

$\Gamma = V-/V+ = (Z_L-Z_0)/(Z_L+Z_0) = 25/125 = 0.2$

V+ = 5 V hence V- = 5x0.2 = 1 V; $V_L = V_s - V- = 5-1 = \underline{4V}$

e) i) Load matching on transmission line. Many students simply gave the trivial solution *d*=0, without considering other values of *d* for which tan(βd) = 0.

e) ii) Load matching on transmission line. Use tuning stubs. Generally well answered.

Question 2

a) Write down equations for **E** and **H** fields of TEM00 wave. Sketch spatial relationship. Most students able to write down equations for E and H fields, but sketches were poor and often contradicted the equations.

b) Poynting vector. Bookwork. Some students failed to mention both properties of **S**, namely power density and direction.

c) E-field strength inside material with $\varepsilon_r = 2$. Many students stuggled with this, though there were also some very elegant solutions. This involved deriving equation for E_t/E_0 ratio. Many students failed to account for the reflected wave.

d) This used Poynting equation, but with E_t and H_t rather than E_0 and H_0.

e) Attenuation of field, given equation for transmission constant. Generally well done, but many students failed to include factor of 2 in exponent to give *power* density fall.

Question 3

a) Bookwork. Some students did not use the fact that div(any curl) = 0 to obtain answer. Units caused some confusion.

b) The main comment here is that some candidates re-derived the given equation for Az, thus wasting time. All that was required was that the given Az be differentiated for parts (i) and (ii).

c) A few attempted the calculation, but not many drew correct sketches. The calculation was made simpler if the modulus was correctly appreciated.

Question 4

a) Bookwork. Some used magnetic field, but needed to remember that RHS is then zero because no magnetic monopole 'charge' exists.

b) Quite well answered by some. Some ignored the fact that analysis of flux through a cube was required by the question.

c) Simple differentiation here, but needed to understand divergence of a vector.