THE INTERNATINONAL UNIVERSITY (IU) – VIETNAM NATIONAL UNIVERSITY – HCMC

Final Examination

Date: January 21, 2018

Duration: 120 minutes

SUBJECT: Electromagnetic Theory	
Dean of School of Electrical Engineering Signature: Full name: Tran Van Su	Lecturer Signature: Full name: Tran Van Su

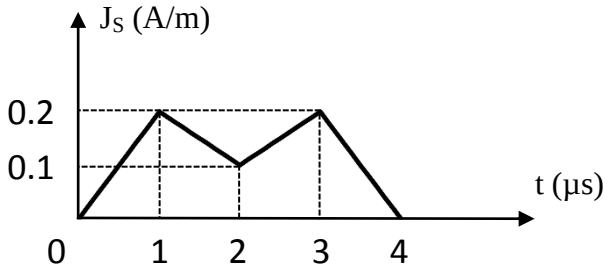
INTRODUCTIONS:

1. One sheet, A4-size paper, with your own hand-writing characters is allowed (Books are prohibited)
2. Laptop and communications devices are not allowed except calculators
3. Answer all questions

Question 1 (20 Marks)

An infinite plane sheet of current density $\overrightarrow{J_S} = -J_S(t)\hat{\boldsymbol{x}}$ (A/m), where $J_S(t)$ is as shown in *Figure* below, lie in the z = 0 in free space. Find and sketch:

a) E_x versus t in the z = 300m plane **(10 Marks)**
b) E_x versus z for t = 1μs **(10 Marks)**



(Note: Students must give calculations and explanations to support the answers)

Question 2 (15 Marks)

The magnetic field of a uniform plane wave in free space is given by

$$\vec{H} = (120\pi)^{-1}\ \cos(6\pi \times 10^8\, t\ +\ \beta y)\hat{\boldsymbol{x}}$$

a) Find the unit vector along the direction of propagation of the wave **(5 Marks)**
b) Find β **(5 Marks)**
c) What is the electric field $\vec{E}$ at t = 0, y = 1/8 m? **(5 Marks)**

Question 3 (15 Marks)

For each of the following values of the displacement flux density at a point on the surface of a perfect conductor, find the surface charge density at points:

a) $\vec{\boldsymbol{D}} = D_o\ (\hat{\boldsymbol{x}} + 2\hat{\boldsymbol{y}} + 2\hat{\boldsymbol{z}})$ and pointing away from the surface **(5 Marks)**
b) $\vec{\boldsymbol{D}} = D_o\ (0.8\hat{\boldsymbol{x}} + 0.6\hat{\boldsymbol{y}})$ and pointing toward the surface **(5 Marks)**
c) If the surface charge density at a point on the surface is zero, find D_o **(5 Marks)**

Assume D_o to be positive for questions *a*, b and c

Question 4 (20 Marks)

The parameters of the medium are given as follows:

$\sigma = 10^{-4}$S/m, $\varepsilon = 4\varepsilon_o$, $\mu = \mu_o$ and $f = 10^6$Hz ($\varepsilon_o = 8.85\text{x}10^{-12}$ F/m, $\mu_o = 4\pi\text{x}10^{-7}$ H/m)

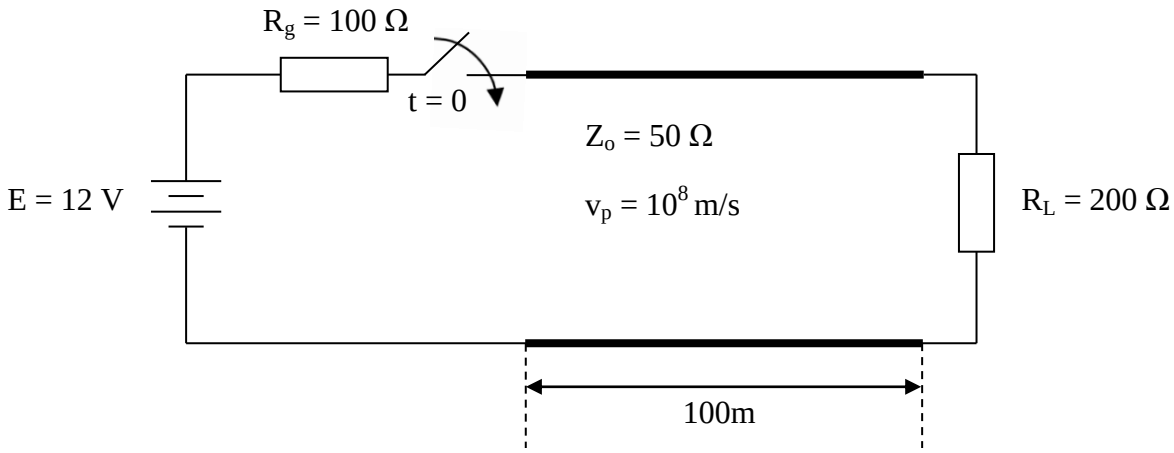
a) Compute the attenuation constant, phase constant and intrinsic impedance **(5 Marks)**
b) If the magnitude of the electric field is E_o, what is the magnitude of the magnetic field? **(5 Marks)**
c) What is the phase different between electric and magnetic fields? **(5 Marks)**
d) Compute the expression of the magnetic field

$$\vec{\boldsymbol{H}} = E_o\ ?\ \cos(?\ t\ -\ ?z\ -?)\hat{\boldsymbol{x}}$$ **(5 Marks)**

Question 5 (25 Marks)

For the Transmission line of the following *Figure*

a) Calculate and sketch the bounce diagram of the voltages for 0 < t < 4μs **(10 Marks)**
b) Find R_L if the voltage at the middle of the line at 2.8μs is 52/9 (V) **(10 Marks)**



Question 6 (10 Marks)

Find I_B at t = 1μs and I_L at t = 2μs