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

Final Examination

Date: May 21, 2016

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

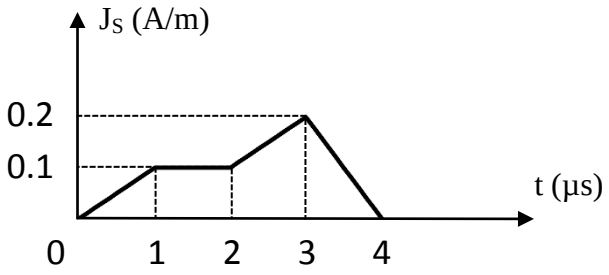
INTRODUCTIONS:

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 $\vec{J}_S = -J_S(t)\hat{x}$ (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 = 600m plane **(10 Marks)**
b) E_x versus z for t = 2μs **(10 Marks)**



Question 2 (15 Marks)

The electric field of a uniform plane wave propagating in the +z direction in a nonmagnetic ($\mu = \mu_o = 4\pi\times10^{-7}$) material medium is given by

$$\vec{\boldsymbol{E}} = 8.4e^{-0.0432z}\cos(4\pi \times 10^6 t - 0.1829z)\,\vec{\boldsymbol{a}_x}\text{(V/m)}$$

Find the magnetic field of the wave (*Hint:* $\overline{\gamma\eta} = j\omega\mu_o$)

Question 3 (10 Marks)

The plane z = 0 forms the boundary between free space (z > 0) and perfect conductor (z < 0)

a) Find $\vec{J}_S(0,0,0)$ at t = 0 and $\vec{H}(0,0,0^+) = H_o(\hat{x} + 2\hat{y})\cos\omega t$ **(5 Marks)**
b) Find $\rho_S(0,0,0)$ at t = 0 and $\vec{D}(0,0,0^+) = E_o\cos\omega t\hat{z}$ **(5 Marks)**

Question 4 (15 Marks)

The sinusoidally time-varying, linearly polarized vector fields are given at a point by

$\vec{F}_1 = \cos(2\pi\times10^6 t + 30^o)\hat{x}$, $\vec{F}_2 = \cos(2\pi\times10^6 t + 30^o)\hat{z}$, $\vec{F}_3 = \sqrt{2}\sin(2\pi\times10^6 t + 30^o)\hat{y}$

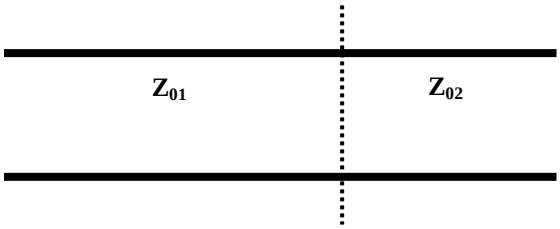
Determine the polarizations of the following vectors:

a) $\vec{F}_1 + \vec{F}_2$ **(7 Marks)**
b) $\vec{F}_1 + \vec{F}_2 + \vec{F}_3$ **(8 Marks)**

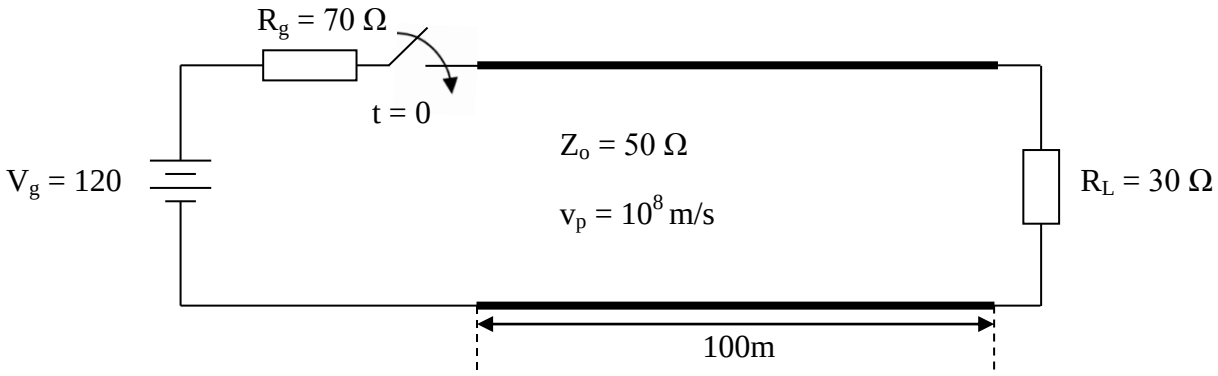
Question 5 (15 Marks)

For the Transmission line of the following *Figure*:

a) The reflected wave voltage is 1/5 times the incident wave voltage **(5 Marks)**
b) The transmitted wave voltage is 1/5 times the incident wave voltage **(5 Marks)**
c) The reflected wave voltage is 1/5 times the transmitted wave voltage **(5 Marks)**



Question 6 (25 Marks)



For the transmission line in *Figure* shown:

a) Sketch the bounce diagram of the voltage and give enough information on it (up to 5μs) **(5 Marks)**
b) Sketch the bounce diagram of the current and give enough information on it (up to 5μs) **(5 Marks)**
c) Determine the voltage at the middle of the line at t = 2.8μs **(5 Marks)**
d) Calculate steady state V_{SS} and I_{SS} **(5 Marks)**
e) Calculate steady state V^+_{SS}, V^-_{SS}, I^+_{SS} and I^-_{SS} **(5 Marks)**