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

Final Examination

Date: May 31, 2013

Duration: 120 minutes

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

INTRODUCTIONS:

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

Question 1 (10 Marks)

For a sinusoidally time-varying plane wave propagating in free space, find the following:

a) The wavelength λ, if the phase of the field at a particular value of time is observed to change by 0.05π in a distance of 2m along the direction of propagation of the wave;

b) The frequency f, if the phase of the field at a point is observed to change by 2π radian in 0.075μs;

c) The wavelength λ, if the frequency is 6MHz;

d) The frequency f, if the wavelength is 20m

Question 2 (20 Marks) D4.9

The magnetic field associated with a uniform wave propagating in the –z direction in a nonmagnetic ($\mu = \mu_o$) material medium is given bay

$$\vec{H} = 10e^{2z}\cos(12\pi \times 10^7 t + 2\sqrt{3}z)\vec{a}_x \text{ (A/m)}$$

Find the following:

a) The instantaneous power flow across a surface of area $1m^2$ in the z = 0 plane at t = 0

b) The time-average power flow across a surface of area $1m^2$ in the z = 0 plane

c) The time-average power flow across a surface of area $1m^2$ in the z = -1 plane

Question 3 (20 Marks)

An infinite plane sheet in the plane carries a surface current of density:

$$\mathbf{J_s} = -0.2\cos 2\pi \times 10^6 t\,\mathbf{a_x}\ \text{A/m}$$

The medium on either side of the sheet is characterized by $\sigma = 10^{-3}$ S/m, $\varepsilon = 6\varepsilon_0$, and $\mu = \mu_o$. Find **E** and **H** on either side of the current sheet.

Question 4 (25 Marks)

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

$$\vec{H} = H_o\cos(6\pi \times 10^8 t - 2\pi y)\hat{z} \text{ (A/m)}$$

Find the following:

a) unit vectors along the direction of propagation of the wave (5 Marks)

b) unit vectors along the direction of magnetic field at t = 0, y =0 (5 Marks)

c) unit vectors along the direction of electric field at t = 0, y =0 (5 Marks)

d) the wavelength of the wave (5 Marks)

e) the pointing vector at t = 0, y = 0 in terms of magnitude and direction (5 Marks)

Question 5 (10 Marks)

Explain shortly why we study Maxwell's equation not only in integral form but also differential form?