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

Mid-term Examination

Date: March 19, 2013

Duration: 90 minutes

SUBJECT: Electromagnetic Theory	
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INTRODUCTIONS:

1. All Notes 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 (20 Marks)

A square loop lies in the xy-plane forming the closed path C connecting the points (0,0,0), (1,0,0), (1,1,0), (0,1,0), and (0,0,0), in that order and the area of this loop of $1m^2$. A magnetic field **B** exists in the region. Determine B_o to obtain the induced emf of 2 [V] around the closed path C at t = 0 for the following magnetic field.

$\vec{B} = B_O \cos(2\pi t + \pi/3)\hat{z}$ [Wb/m^2]

Question 2 (25 Marks)

Three point charges $Q_1(t)$, $Q_2(t)$, and $Q_3(t)$ situated at the corners of an equilateral triangle of sides 1m are connected to each other by wires along the sides of the triangle. Current 1A flows from Q_1 to Q_2. The displacement currents emanating from two spherical surfaces of radii 0.1m and centered at Q_1 and Q_3 are -2A and 2A, respectively. Find the following:

a. the current flowing from Q_1 to Q_3 (10 Marks)

b. the current flowing from Q_2 to Q_3 (10 Marks)

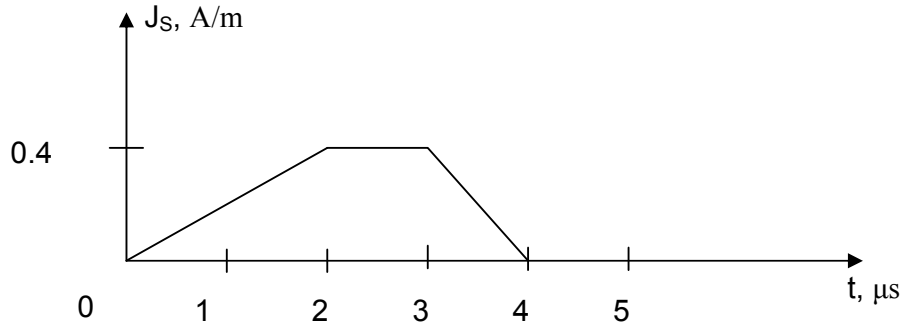
c. the displacement current emanating from spherical surface of radius 0.1m and centered at Q_2 (5 Marks)

Question 3 (20 Marks)

An infinite plane sheet lying in the z = 0 plane in free space ($v_p = 3.10^8$m/s, $\eta_o = 120\pi\ \Omega$) carries a surface current of density $\vec{J}_S = -J_S\vec{a}_x$, where $J_S(t)$ is shown in Figure below. Find and sketch:

a. E_x versus t in the z = 600m plane (10 Marks)

b. H_y versus z for t = 2μs (10 Marks)



Question 4 (25 Marks)

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

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