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

Mid-term Examination

Date: March , 2016

Duration: 90 minutes

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

INTRODUCTIONS:

1. Each student can use his/her note (one paper of A4 size). Other materials and devices are not allowed except calculators.
2. Answer all questions

Question 1 (25 Marks)

A conducting cylinder (M) which is depicted in Fig. 1 has radius of a (m) and charge density of ρ_S (C/m^2), respectively. In the free space, determine:

a. Total displacement flux crossing the concentric cylinder which has the radius r > a and length of 2 (m). (10 Marks)

b. The displacement flux D(r). (5 Marks)

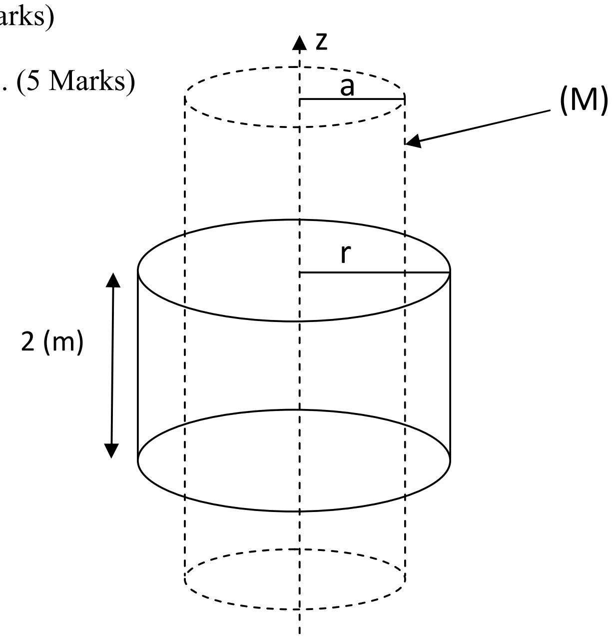

Fig. 1

c. If a = 0 and $\rho_s = \rho_L$ (c/m), Repeat question a and b. (10 Marks)

Question 2 (25 Marks)

Given $\vec{A} = x^2 yz\hat{x} + y^2 zx\hat{y} + z^2 xy\hat{z}$,

a. Evaluate $\oint_S \vec{A}.d\vec{S}$, where S is the surface of the cubical box bounded by the planes x = 0, x = 1, y = 0, y = 1, z = 0, and z = 1. (15 Marks)

b. Show that the divergence theorem is also satisfied with $\vec{A}$ and the cubical box in question (a). (10 Marks)

Question 3 (25 Marks)

An infinite plane sheet of current density $\vec{J}_S = -J_S(t)\hat{x}$ (A/m) where $J_S(t)$ is shown in Fig. 2, lies in the z = 0 plane in free space. If The phase velocity is 3.10^8 m/s. Plot

a. E_x versus t in the z = - 300m plane. (10 Marks)
b. H_y versus t in the z = 600m plane. (10 Marks)
c. E_x versus z at t = 1μs. (5 Marks)

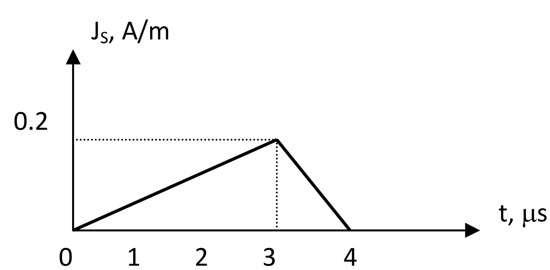

Fig. 2

Question 4 (25 Marks)

For the plane wave in free space, the electric field is defined as follows

$$\vec{E} = E_o \cos(6\pi \times 10^8 t + 2\pi x)\hat{z} \text{ (V/m)}$$

Compute:

a) velocity of the wave. (3 Marks)

b) the wavelength of the wave. (2 Marks)

c) Magnetic field $\vec{H}$. (5 Marks)

d) Vector poynting. (5 Marks)

e) $\nabla \times \vec{E}$. (5 Marks)

f) $\nabla \times \vec{H}$. (5 Marks)