THE INTERNATIONAL UNIVERSITY (IU) – VIETNAM NATIONAL UNIVERSITY - HCMC

FINAL EXAMINATION – CLASS

Student Name: _____ Student ID: _____

Date: August 2018

Duration: 90 minutes

SUBJECT: PHYSICS 3	Lecturer:
Chair of Department of Physics:	Signature:
Signature:	
Full name: Phan Bảo Ngọc	Full name: Dương Hoài Nghĩa

INSTRUCTIONS: This is a closed book examination. Use of cell phones, laptops, dictionaries is not allowed.

1) In Fig. 1, a metal wire of mass m = 25 mg can slide with negligible friction on 2 horizontal parallel rails separated by distance d = 4 cm. The track lies in a vertical uniform magnetic field of magnitude 50 mT. A source is connected to the rails, producing a constant current i = 10 mA in the wire and rails. Find the magnitude and the direction of the force acting on the wire. *(20 pts)*

2) The magnitude of the electric field between the two circular parallel plates is E = 100exp(-2t) V/m (Fig. 2). The plate area is A = 0.04 m². Determine

a) The magnitude and the direction of the displacement current between the plates. *(10 pts)*

b) The magnitude and the direction of the induced magnetic field between the plates. *(10 pts)*

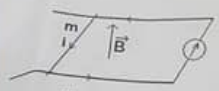


Fig. 1


Fig. 2

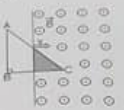


Fig. 3

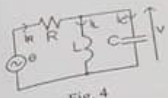


Fig. 4

3) In Fig.3, the triangle ABC is moving into a magnetic field B with velocity v. If the triangle has resistance R, find the magnitude and the direction of the current i in the triangle. Let AB = a, BC = b. *(20 pts)*

4) Given the circuit in Fig. 4 with e(t) = 100cos(1000t) V, R = 100 Ω, L = 0.1 H, C = 10 μF. Find the voltage v and the currents i_R, i_L, i_C. *(20 pts)*

5) The electric field component of an electromagnetic wave in vacuum is $\vec{E} = E_0 \sin(\omega t - kx)\vec{a}_y$. Find the magnetic field $\vec{B}$ and the Po ynting vector *(20 pts)*.

END OF QUESTION PAPER

Thứ
Ngày . . No.

August 2018

$\vec{F_B} = i\vec{L} \times \vec{B} \Rightarrow \begin{cases} \vec{F_B} \text{ to the left} \\ |\vec{F_B}| = 10 \times 10^{-3} \times 0.04 \times 50 \times 10^{-3} = 2 \times 10^{-5} \text{ (N)} \end{cases}$

1 E = $100 e^{-2t}$

a1 Displacement current: $i_d = \varepsilon_0 \frac{d\Phi_E}{dt} = \varepsilon_0 . A . \frac{dE}{dt}$

$= 8.85 \times 10^{-12} \times 0.04 \times (-200) e^{-2t}$

$= -7.08 \times 10^{-11} \times e^{-2t}$ (A)

B_c $i_d < 0 \Rightarrow \vec{i_d}$ oppose the direction of $\vec{E}$ (discharge)

↳ To the left

b1

$\oint \vec{B} d\vec{s} = \mu_0 i + \mu_0 i_d$

We only consider Bw the plate $\Rightarrow \mu_0 i = 0$

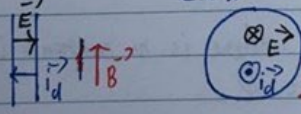
$\Rightarrow \oint \vec{B} d\vec{s} = \mu_0 i_d \Rightarrow B 2\pi r =$

For our Algebra expression, we only care abt magnitude.

↳ $B 2\pi r = 7.08 \times 10^{-11} \times e^{-2t} \times \mu_0 = 8.9 \times 10^{-17} e^{-2t}$

$\Rightarrow B = \frac{8.9 \times 10^{-17} e^{-2t}}{2\pi r}$ (with $0 < r < R$; R being the radius of the plate)

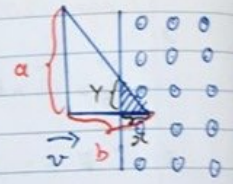
Direction:



8

Thứ
Ngày . . No.

3) $\mathcal{E} = \frac{d\Phi_B}{dt}$ (emf) ; $i = \frac{\mathcal{E}}{R}$



$\mathcal{E} = \frac{d\Phi_B}{dt} = B \cdot \frac{dA}{dt} = B \cdot \frac{d(x \cdot y)}{dt}$

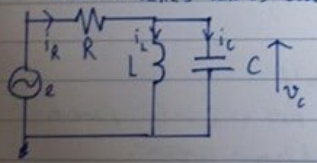
$= B\left(x\frac{dy}{dt} + y\frac{dx}{dt}\right)$ (1)

$\frac{x}{y} = \frac{b}{a} \Rightarrow y = \frac{a}{b}x \Rightarrow \frac{dy}{dt} = \frac{a}{b}\frac{dx}{dt} = \frac{a}{b}v$

From (1) and (2) $\Rightarrow \mathcal{E} = B\left(\frac{a}{b}x\frac{dx}{dt} + \frac{a}{b}x\frac{dx}{dt}\right) = \frac{2xBa}{b}v$

$\Rightarrow i$ { Magn: $\frac{\mathcal{E}}{R} = \frac{2Bvxa}{b}$
Direction: Lenz's law $\Rightarrow$ Clockwise

4)



$e(t) = 100\cos(1000t)$
$= 100\sin(1000t + 90°)$
$R = 100\,\Omega$; $C = 10\mu F \Rightarrow Z_C = 100\,\Omega$
$L = 0.1\,H \Rightarrow Z_L = 100\,\Omega$

$v_c = V_M \sin(1000t + \varphi)$
$\hookrightarrow i_c = \frac{V_M}{100}\sin(1000t + \varphi + 90°)$; $i_R = i_L + i_C = 0$
$i_L = \frac{V_M}{100}\sin(1000t + \varphi - 90°)$

in another word, there is no current in this circuit
$\hookrightarrow i_R = i_C = i_L = 0$