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

FINAL EXAMINATION – CLASS

Student Name:________________________ **Student ID:**____________________

Date: January 2015

Duration: 120 minutes

SUBJECT: **PHYSICS 3**	
Chair of Department of Physics: Signature: Full name: Phan Bao Ngoc	Lecturer: Signature: Full name: Phan Bao Ngoc

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

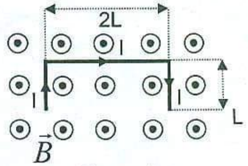


Figure 1

1/ (15 pts) An electron moving along a circular path in a plane perpendicular to a uniform magnetic field of 60 μT. Determine the time needed to complete one revolution of the electron. ($e = 1.6\times10^{-19}$ C; $m_e = 9.1\times10^{-31}$ kg) 5.96×10^{-7}

2/ (15 pts) A wire of total length 4L and carrying a current I is placed in a uniform magnetic field B that is directed out of the page as shown in Figure 1. Determine the net magnetic force (magnitude and direction) on the wire. 2iLB

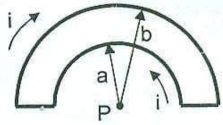


Figure 2

3/ (20 pts) In Figure 2, current i = 40 mA is set up in a loop having two radial lengths and two semicircles of radii a = 5 cm and b = 8 cm with a common center P. What are the (a) magnitude and (b) direction (into or out of the page) of the magnetic field at P and the (c) magnitude and (d) direction of the loop's magnetic dipole moment? ($\mu_0 = 4\pi\times10^{-7}$ T.m/A) $B\ 4.1\times10^{-7}$
$\mu = 4.8\times10^{-4}$

4/ (15 pts) Each turn of a 200-turn coil encloses an area of 0.85 m^2. Determine the rate of change of a magnetic field parallel to the coil's axis in order to induce a current of 0.2 A in the coil. The resistance of the coil is 500 Ω. 2.55×10^{-6}

5/ (15 pts) A coil has a resistance of R = 5.0 Ω and an inductance of L = 200 mH. At a particular instant in time after an ideal battery is connected across the coil, the current is i = 1.4 A, and is increasing at a rate of di/dt = 10 A/s. Calculate the emf ε of the battery, the inductive time constant of the circuit, and the final value of the current. (*Hint*: Use the loop rule to calculate ε) $\varepsilon = 9V$ $\tau_L = 40\times10^{-3}$

6/ (20 pts) An alternating source drives a series RLC circuit with an emf amplitude of 12 V, at a phase angle of $\phi = +45^0$. When the potential difference across the capacitor reaches its maximum positive value of +4.5 V: (a) sketch the phasor diagram of the circuit; (b) determine the potential difference across the inductor (sign included).

END OF QUESTION PAPER

Thứ
Ngày . . . No.

Jan 2015 – Nguyễn Trọng Nghĩa

1/

$$T = \frac{2\pi r}{v} = \frac{2\pi m_e}{eB}$$

$$= \frac{2\pi \times 9.1 \times 10^{-31}}{1.6 \times 10^{-19} \times 60 \times 10^{-6}} = 6.1 \times 10^{-7} (s)$$

2/

$$\vec{F}_B = i \vec{L} \times \vec{B}$$

However, as the force created by 2 vertical segment cancel each other out.

$$\Rightarrow F_B = i \times 2L \times B$$

$$= 2iLB$$

with direction poiting down given by the right-hand rule

3/

a, b/ B_a is pointing into the page
B_b " out of the page.

Choosing the positive direction as into the page.

$$|B_{net}| = B_a - B_b = \frac{\mu_0 \times i \times \pi}{4\pi \times R_a} - \frac{\mu_0 \times i \times \pi}{4\pi \times R_b}$$

$$= 9.4 \times 10^{-8} (T)$$

Therefore, At P, the magnetic field is pointing into the page with magnitude 9.4×10^{-8} ~~(T)~~ ~~Telsa~~ Tesla.

c, d/

$$\mu = NiA = 1 \times 40 \times 10^{-3} \times \frac{1}{2}(\pi \times R_b^2 - \pi R_a^2)$$

$$= 2.45 \times 10^{-4} (A.m^2)$$

Because the current is clockwise → $\vec{\mu}$ is pointing into the page
Therefore, magnetic dipole moment is pointing into the page with ~~mg~~ magnitude 2.49×10^{-4} $(A \cdot m^2)$

4/

$\mathcal{E} = iR = 0.2 \times 500 = 100\ (V)$

$\mathcal{E} = N \dfrac{d\Phi}{dt} \Rightarrow 100 = 200 \times \dfrac{d(B \times A)}{dt} \Leftrightarrow \dfrac{1}{2} = A \times \dfrac{dB}{dt}$

$\Rightarrow \dfrac{dB}{dt} = 0.6\ (T/s)$

5/

Loop Rule: (Thầy chơi khó lắ :0)

$-iR - L\dfrac{di}{dt} + \mathcal{E} = 0$

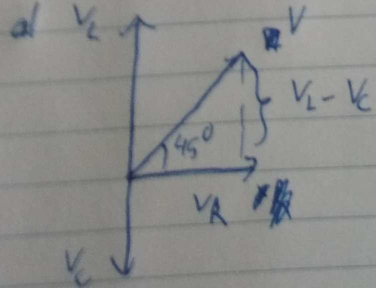
$\Leftrightarrow -1.4 \times 5 - 200 \times 10^{-3} \times 10 + \mathcal{E} = 0 \Leftrightarrow \mathcal{E} = 9\ (V)$

$\tau_L = \dfrac{L}{R} = \dfrac{200 \times 10^{-3}}{5} = 0.04\ (s)$

Final value of $i = \dfrac{\mathcal{E}}{R} = \dfrac{9}{5} = 1.8\ (A)$

6/

a/



b/ $\cos 45^0 = \dfrac{V_R}{V} \Rightarrow V_R = 6\sqrt{2}\ (V)$

$\tan 45^0 = \dfrac{V_L - V_C}{V_R} \Rightarrow V_R = V_L - V_C$

$\Rightarrow V_L = V_R + V_C = 6\sqrt{2} + 4.5$
$= 13\ (V)$