INTERNATIONAL UNIVERSITY (IU) – VIETNAM NATIONAL UNIVERSITY - HCMC

FINAL EXAMINATION – CLASS

Student Name:_____ Student ID:_____

Date: January 2017

Duration: 120 minutes

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

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

1/ (20 pts) A potential difference of 1000 V is applied to accelerate an electron from rest. The accelerated electron then enters a uniform magnetic field and completes one revolution in 10 ns. Determine the radius of the orbit of the electron. ($e = 1.6\times10^{-19}$ C; $m_e = 9.1\times10^{-31}$ kg)

2/ (15 pts) A closed loop with an area of 6.0×10^{-2} m^2 carries a current of 5.0 A. The loop is placed in an external magnetic field of 0.7 T. The dipole moment of the loop initially makes an angle of 60^0 with the magnetic field. Calculate the work done by the magnetic field as it rotates the loop from its initial orientation to a final one where the dipole moment is aligned with the magnetic field.

3/ (15 pts) Two infinite parallel wires are separated by 1.0 cm and carry currents of 5 A and 7 A in the opposite direction. Find the force (magnitude and direction) per unit length acting on each wire. ($\mu_0 = 4\pi\times10^{-7}$ T.m/A)

4/ (15 pts) A conducting loop of area 50 cm^2 is perpendicular to a magnetic field that increases uniformly in magnitude from 0.1 T to 7.5 T in 2.0 s. Find the resistance of the loop if the induced current has a value of 1.5 mA.

5/ (15 pts) The current in an RL circuit drops from 1.0 A to 10 mA in the first second after removing the battery from the circuit. Determine the inductance L if the resistance R is 40 Ω. (Decay of current $i = i_0 e^{-t/\tau_L}$)

6/ (20 pts) In an oscillating LC circuit, L = 3.0 mH and C = 2.7 μF. At t = 0 the charge on the capacitor is zero and the current is 2.0 A. **(a)** Find the maximum charge that will appear on the capacitor; **(b)** At what earliest time $t > 0$ is the rate at which energy is stored in the capacitor $\frac{dU_E}{dt}$ greatest, and **(c)** what is that greatest rate? (*Hint*: $q = Q\cos(\omega t + \phi); i = -I\sin(\omega t + \phi); U_E = \frac{q^2}{2C}$)

END OF QUESTION PAPER

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1)

Để ý đơn vị của Voltage ($\frac{J}{C}$)

↳ có nghĩa là khi đặt một điện tích q(C) qua hết này, điện tích đó đc cung cấp năng lượng

$K = \frac{1}{2}mv^2 = e.U$

$\Leftrightarrow \frac{1}{2} \times 9.10 \times 10^{-31} \times v^2 = 1.6 \times 10^{-19} \times 1000$

$\Rightarrow v = 1.875 \times 10^7 \ (m/s)$

$T = \frac{2\pi r}{v} \Rightarrow r = \frac{v.T}{2\pi} = 3 \times 10^{-5} \ (s)$

2)

$W = U(\frac{\pi}{3}) - U(0)$

$\Leftrightarrow W = 0 - (NBS\cos(\frac{\pi}{3}) - NBS\cos 0)$

$= 1 i.AB\ (\cos 0 - \cos\frac{\pi}{3})$

$= 0.105 \ (J)$

3)

Force per unit length => Unit is: $\frac{N}{m}$

• Ta: $\frac{F}{L} = \frac{\mu_0 . i_1 . i_2}{2\pi d} = \frac{10 \times 5 \times 7}{2\pi 0.01} = 7 \times 10^{-4} \ (\frac{N}{m})$

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4| $\frac{dB}{dt} = \frac{\Delta B}{\Delta t} = \frac{1.5 - 0.1}{2 - 0} = 3.7 \left(\frac{T}{s}\right)$

$|\mathcal{E}| = \frac{d\Phi_B}{dt} = A \cdot \frac{dB}{dt} = 0.0185 \ (V)$

$R = \frac{\mathcal{E}}{i} = \frac{0.0185}{1.5 \times 10^{-3}} = 12.3 \ (\Omega)$

5|

$i = i_0 e^{-t/\tau_L} \quad (\text{Với } \tau_L = \frac{L}{R})$

$\Leftrightarrow 10 \times 10^{-3} = 1 \cdot e^{-1/\tau_L}$

$\Leftrightarrow -4.6 = \frac{-1}{\tau_L} \Leftrightarrow \tau_L = 0.217$

$\Rightarrow L = 8.68 \ (H)$

6|

$\omega = \frac{1}{\sqrt{LC}} \Rightarrow \omega = \frac{10000}{9} \ (rad/s)$

a| ~~$i = 0$~~

$I = \omega \cdot Q \Rightarrow Q = \frac{I}{\omega} = 1.8 \times 10^{-4} \ (C)$

Câu này vui này :

b and c|

$U_E = \frac{q^2}{2C} \Rightarrow \frac{dU_E}{dt} = \frac{q}{C} \cdot \frac{dq}{dt}$ ← this is current

Mình chọn $-\frac{\pi}{2}$ vì $t = 0 \Rightarrow q = 0$

$\Rightarrow \frac{dU_E}{dt} = \frac{Q}{C} \cos\left(\omega t - \frac{\pi}{2}\right) \cdot -I \sin\left(\omega t - \frac{\pi}{2}\right)$

$= (-I)\frac{Q}{C} \cdot \frac{1}{2} \sin(2\omega t - \pi)$

$\Rightarrow$ Maximum $\Rightarrow 2\omega t - \pi = \frac{\pi}{2} \Leftrightarrow t = 7.07 \times 10^{-4} (s)$

This greatest rate is: $\frac{400}{3} \ (J/s)$