UESTC Student ID_____ UOG Student ID_____ Course Title_____ Lecturer_____

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Glasgow College, UESTC

Physics II —Semester 1, 2018 - 2019

Final Exam

xx:xx—xx:xx, xx, xx, Jan, 2019

Notice: Please make sure that both your UESTC and UoG Student IDs are written on the top of every sheet. This examination is closed-book. The use of a calculator is allowed, but the use of a cell phone is not permitted. All scratch paper must be adequately labeled. Unless indicated otherwise, answers must be derived or explained clearly. Please write within the space given below on the answer sheets.

All questions are compulsory. There are 6 questions and a maximum of 100 marks in total.

The following table is for grader only:

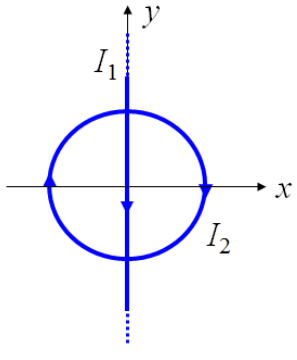
Question	1	2	3	4	5	6	Total	grader
Score								

Score

Question 1 Multiple-choice Questions (3×6=18 points)

Choose the ONE alternative that best complete the statement or answer the questions.

( ) 1. Infinitely long current I_1 and circular current I_2 are insulated, and they lie on the same plane. What is the direction of magnetic force acting on current I_2?



A) + *x* direction;

B) − *x* direction;

C) + *y* direction;

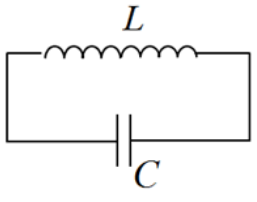
D) − *y* direction.

( ) 2. There are some equations and statements about the electrostatic field E_0 and induced electric field E_i. Which of them is correct?

A) $\oiint \vec{E}_i \cdot d\vec{S} = 0$. **B)** $\oiint \vec{E}_0 \cdot d\vec{S} = Q_{in}$.

C) Both of these two types of field are conservative. **D) Both of these two types of field are produced by electric charges.**

( ) 3. In an LC circuit, the current changes as $I = I_0 \cos \omega t$, then what is the energy stored in the Capacitor?



A) $U = \frac{1}{2} C I_0 \cos^2 \omega t$; **B)** $U = \frac{1}{2} C I_0 \cos^2 \omega t$; **C)** $U = \frac{1}{2} L I_0 \cos^2 \omega t$; **D)** $U = \frac{1}{2} L I_0 \sin^2 \omega t$.

( ) 4. There are some statements about the Photoelectric Effect. Which of them is NOT correct?

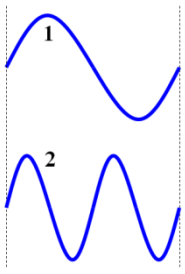
A) The stopping voltage increases if the intensity of incoming light increases.

B) The stopping voltage increases if the frequency of incoming light increases.

C) An electron absorbs a photon so that it can escape from the metal surface.

D) If the frequency of incoming light is lower than the cutoff frequency, there is no photocurrent.

( ) 5. The following figure shows the de Broglie wave of particle 1 and particle 2. Then what is the relationship about their momentums?



A) $p_1 = 2p_2$; B) $p_1 = 4p_2$; C) $p_2 = 2p_1$; D) $p_2 = 4p_1$.

( ) 6. According to the rules of quantum numbers of electrons inside atom, which of the following electron configuration is possible?

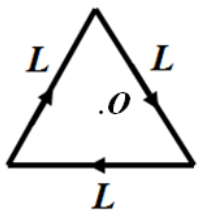
A) $1s^2 2s^3 2p^3$; B) $1s^2 2s^2 2p^5 3s^2$; C) $1s^2 2s^2 2p^6 2d^2$; D) $2s^2 2p^8 3s^2$.

Score

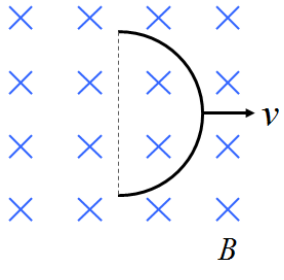
Question 2 Fill-in Questions (4×4=16 points)

1. Consider an equilateral triangle wire (length *L* for each side) with current *I*, how much is the magnetic field produced at its center o?

***B* = _____.**



2. A semicircular wire (radius R) is moving with speed *v* in the plane it lays, the moving direction is perpendicular to the diameter line (dashed line in the figure). If there is a magnetic field *B*, how much is the EMF in the wire? ε = _____.



3. Write out the Maxwell's equations corresponding to the description.

a. Electric field can be produced by changing magnetic field: _____

b. Magnetic field can be produced by different ways: _____

4. An electron in the second shell may have a group of quantum numbers like $(n = 2, l = 0, m_l = 0, m_s = \frac{1}{2})$. List 3 other possible groups of quantum numbers for it.

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Score

Question 3 (20 points)

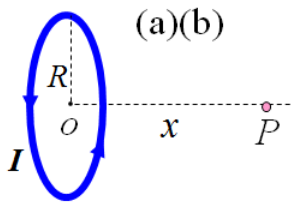
Consider a circular loop (radius *R*) with a current *I*.

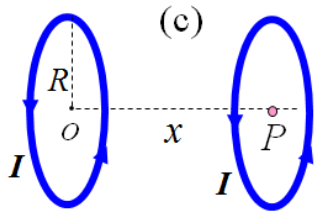
(a) Calculate the magnetic field produced at point P (distance *x* from the center o) on its axis.

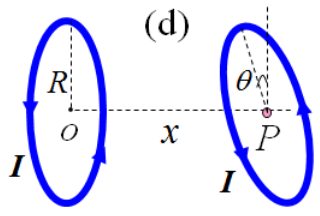
(b) How much is the magnetic moment μ?

(c) If another identical loop is place on point P, what is the mutual inductance *M* between these two loops? (Suppose *x* >> *R*, and two loops are coaxially placed)

(d) If the second loop rotates about P for an angle θ and then it is released from rest, describe its motion. (Only consider the action of magnetic force, the mass of loop is *m*)







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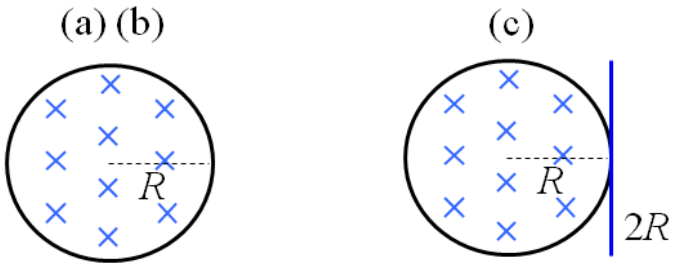
Question 4 (16 points)

Uniform magnetic field exists only in a cylindrical space with radius R, and it changes as dB/dt = C > 0, where C is a constant.

(a) Calculate the induced electric field inside the cylindrical space.

(b) Calculate the induced electric field outside the cylindrical space.

(c) If a straight wire (length 2R) lays tangent to the solenoid at its center. What is the EMF in the wire?



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Question 5 (20 points)

Radiation from the Sun reaches the Earth at a rate about 1350W/m^2.

(a) Assume it is a single electromagnetic wave, calculate the maximum electric field caused by this wave.

(b) Light is transmitted as photons, so if 100J sunshine is received by some device, how much photons are there? Assume that all the photons in sunshine have the same wavelength 550nm.

(c) Sometimes radiation may hurt human being. Visible light is also some kind of radiation, does it easily hurt human?

(d) What kinds of radiation are more dangerous to human being, and how do they cause the damage?

($h = 6.63\times10^{-34}\,J\cdot s$, $c = 3.00\times10^{8}\,m/s$, $\varepsilon_0 = 8.85\times10^{-12}\,C^2/N\cdot m^2$, $e = 1.60\times10^{-19}\,C$)

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Question 6 (10 points)

The wave function of a microscopic particle can be expressed as $\psi = \begin{cases} Cx(1-x), & 0 \le x \le 1 \\ 0, & x < 0 \text{ or } x > 1 \end{cases}$ **, where C is a constant to be determined.**

(a) Where does the particle have maximum probability density?

(b) What is the constant C?

(b) What is the probability to find the particle in region $0 < x < \frac{1}{3}$ **? (The probability distribution is given by** $|\psi|^2$ **)**