HOCHIMINH CITY
UNIVERSITY OF TECHNOLOGY AND EDUCATION
FACULTY OF APPLIED SCIENCES

FINAL EXAM
2nd SEMESTER – ACADEMIC YEAR 2019-2020
Subject: Principles of Physics 2
Course Number: PHYS130502E
Test number: 01 (2 pages).
Duration: 90 minutes.

Note:
+ Students are allowed to use one hand-written A4 paper sheet as a memory aid.
+ Proctors are NOT allowed to explain anything related to contents of the test.
+ The permeability of free space is $\mu_0 = 4\pi \times 10^{-7}$ T.m/A. *The Coulomb constant is* $k = 9.00 \times 10^9$ N.m^2/C^2.

Question 1: (0.5 marks)
An object with negative charge is placed in a region of space. The electric field at this position is directed horizontally southward. What is the direction of the electric force exerting on this charge?

A. It is horizontal, northward. **B.** It is horizontal, southward.
C. There is no force. **D.** The force can be in any direction.

Question 2: (0.5 marks) A solid insulating sphere carries positive electric charge uniformly distributed throughout its volume. Concentric with the sphere is a conducting spherical shell with no net charge as shown in Figure 1. Consider the electric flux through concentric spherical surfaces through points A, B, C, and D. A is located inside the solid sphere. C is inside the shell. Which statement is **incorrect**?

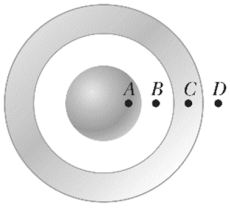

Figure 1.

A. $\Phi_B = \Phi_D$ **B.** $\Phi_A > \Phi_C$ **C.** $\Phi_A = \Phi_D$ **D.** $\Phi_D > \Phi_A$

Question 3: (0.5 marks) An electromagnetic wave with a peak magnetic field magnitude of 1.50×10^{-7} T has an associated peak electric field of what magnitude?

A. 0.500×10^{-15} N/C **B.** 2.00×10^{15} N/C
C. 2.25×10^{4} N/C **D.** 45.0 N/C

Question 4: (0.5 marks) A Fraunhofer diffraction pattern is produced on a screen located 1.00 m from a single slit. If a light source of wavelength 0.500 μm is used and the distance from the center of the central bright fringe to the first dark fringe is 5.00 mm, what is the slit width?

A. 0.0100 mm **B.** 0.100 mm **C.** 0.200 mm **D.** 1.00 mm

Question 5: (1.0 mark) A loop of wire is moving with constant velocity near a long, straight wire carrying a constant current *I* as shown in Figure 2.

(a) Determine the direction of the induced current in the loop as it moves away from the wire.

(b) What would be the direction of the induced current in the loop if it were moving toward the wire?

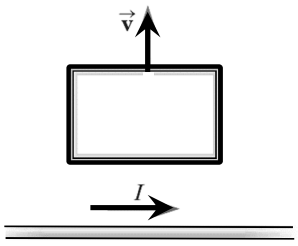

Figure 2.

Question 6: (1.0 mark) There are two parallel wires carrying currents with the same direction. Do they attract or repel each other? Explain your answer.

Question 7: (2.0 marks) Four charged particles are at the corners of a square of side $a = 0.050$ m as shown in Figure 3. Given $q = 6.00\times10^{-6}$ C.

a) Determine the electric field at the center O of the square.
b) The fifth particle with charge of $-q$ is placed at O. Determine the total electric force that exerts on this particle.

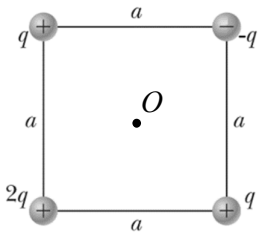

Figure 3.

Question 8: (2.0 marks) In a plane, there are two concentric circular loops of wire carrying currents of $I_1 = 5.00$ A and I_2 as in Figure 4. Th e radii of the two circle are $r_1 = 12.0$ cm and $r_2 = 9.00$ cm respectively.

a) Find the direction and the magnitude of I_2 so that the total magnetic field at center O of the loops is zero.
b) If I_2 has the same direction but its magnitude is twice of the value found in a), determine the net magnetic field at the O.

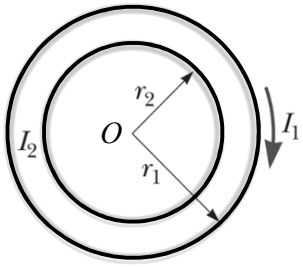

Figure 4.

Question 9: (2.0 marks) A film of MgF_2 ($n = 1.38$) having thickness of 5.00×10^{-5} cm is used to coat a camera lens. The lens is made of glass with the index of refraction 1.50.

a) What are the three longest wavelengths that are most strongly reflected?
b) Are any of these wavelengths in the visible spectrum (wavelength in the range of 0.380 μm to 0.760 μm)?

The End

ELO of the subject (knowledge)	Test contents
[ELO 1.1]: Understanding various concepts, and laws related to electric and magnetic fields, and the theorem of electromagnetic field.	Questions: 1, 2, 3, 5, 6,7, 8
[ELO 2.1]: Applying the knowledge of electric and magnetic fields to explain phenomena and to solve the related problems.	Questions: 1, 2, 3, 5, 6,7, 8
[ELO 3.1]: Understanding various concepts, and laws related to ray optics and wave optics	Question: 4, 9
[ELO 3.2]: Applying the knowledge of ray and wave optics to explain phenomena and to solve the related problems.	Question: 4, 9

Date: July 10th 2020
Head of Physics Department
(Signature and full name)