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القرفة الاولى

٥١١ - ٥١٩ ٢٢٢٥

Menofia University
Engineering Physics Department
First Year- First Term
Date: 21/1/2019
Full Mark: 90 (for the two parts)



Faculty of Electronic Engineering
Engineering Physics3
Final Exam.
Time: 3hrs (10-13)

Physical Constants: $m_e = 9.1 \times 10^{-31} \text{ Kg}$ $e = 1.6 \times 10^{-19} \text{ C}$ $h = 6.6 \times 10^{-34} \text{ Js}$
 $c = 3 \times 10^8 \text{ m/s}$ $k = 1.38 \times 10^{-23} \text{ J/K}$

Answer The Following Questions:

- 1-a) Explain the physical meaning and the properties of the wave function (ψ) according to quantum theory. [5Marks]
- 1-b) Consider an electron of mass (m) moving in x-direction in an infinite potential well of width (L), such that ($V=0$) inside and ($V=\infty$) outside the well. Find and draw the eigenfunctions, the eigenvalues and the probability of finding the electron for $n = 1, 2, 3$. [5Marks]
- 1-c) Calculate the amount of energy emitted radiation when an electron in a three-dimensional box of side length 0.5 nm makes transition from the third excited state to the first excited state. Find the corresponding wavelength of the emitted radiation. [5Marks]

- 2-a) Define: 1-Degeneracy 2-Zeeman effect 3-Fermi energy level
4-Pauli exclusion principle 5-Heizenberg uncertainty principle [5Marks]
- 2-b) Plot the energy of electrons (E) against the wave number (k) for free electron theory and band theory. Then show the first and second Brillouin zones. [5Marks]
- 2-c) Calculate the probability of electron occupancy for state whose energy is:
i) 0.1 eV above Fermi energy level. ii) 0.1 eV below Fermi energy level.
iii) equal to Fermi energy level.
Assume the temperature of 800 K . [5Marks]

- 3-a) Explain the following:-
i) Meissner effect ii) Electron pairs formation in BCS theory [5Marks]
- 3-b) Compare between type-I and type-II superconductors. [5Marks]
- 3-c) Determine the maximum kinetic energy of electrons ejected from potassium surface by ultraviolet light of wavelength 2000 \AA . Find the retarding potential difference required to stop the emission of electrons. The photoelectric threshold wavelength for potassium is 4400 \AA . [5Marks]

Good luck

Dr. Ahmed Abo Arais

أولى باقى الورق
14-15
14-15

4.a) Briefly discuss nanostructures in terms of their dimensionality. [5Marks]

4.b) What are the confinement regimes for quantum dots with infinite potential barriers? [5Marks]

4.c) What are the possible applications of nanostructures? [5Marks]

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5.a) How are X-rays generated? Describe the construction and operation of Coolidge X-ray tube. How are intensity and hardness of X-rays controlled? [5Marks]

5.b) Why exposure to X-ray injurious to health but exposure to visible light is not, when both are electromagnetic waves? [5Marks]

5.c) What is the coordination number? Calculate the coordination number for simple cubic, bcc and FCC lattices? [5Marks]

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6.a) Explain why the properties of polycrystalline materials are most often isotropic? [5Marks]

6.b) Briefly discuss the similarities and difference between photons and phonons. [5Marks]

6.c) Briefly explain why some transparent materials appear colored whereas others are colorless. [5Marks]

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مع خالص أمنياتى بالتوفيق والنجاح ا.د سناء محمود الربيعي،