أولى نصف العام ٢٠٢٠

Menoufia University
Engineering Math.& Physics Department
Final Exam–First Year-First Semester
Date: 23/1/2020

Faculty of Electronic Engineering
Engineering Physics3
Time: 3hr (10-13)
Full Mark : 90(each Question 15-each part 5)

Examiners Prof.Mohamed Daowud and Dr.Ahmed Abo Arais

Plank's constant $= 6.62 \times 10^{-34} J.s$, velocity of light $c = 3 \times \frac{10^8 m}{s}$, mass of electron $m = 9.1 \times 10^{-31} Kg$, charge of electron $e = 1.6 \times 10^{-19} C$, *Boltzmann constant* $k = 1.38x10^{-23} J/K$

Answer the Following Questions:-

[1-a] Discuss briefly the particle-wave duality according to quantum theory.

[1-b] Consider an electron of mass (m) moving in x-direction in a finite potential well of width (L), such that (V=0) inside and (V=Vo) outside the well. Find the eigenfunctions and the eigenvalues.

[1-c] Explain the effect of well depth on the probability of finding the electron and the effect of well size on energy levels.

[2-a] Compare between Fermi-Dirac and Maxwell-Boltzmann distributions.

[2-b] Draw the band diagram and indicate the Fermi level for:

i) Conductors ii) Semiconductors iii) Insulators

[2-c] Electrons with a maximum kinetic energy of 3eV are ejected from a metal surface by ultraviolet radiation of 1500A. Compute:-
i) the work function of the metal ii) the threshold wavelength iii) the stopping potential

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[3-a]Define the transition temperature of a superconductor and describe two ways to determine it.

[3-b] Discuss the Meissner effect then compare between typeI and typeII superconductors.

[3-c] Calculate the emitted frequency and wavelengthwhen an electron in a three-dimensional well makes a transition from the second excited state to the ground state. Assume the well is cubic of side length 0.5nm.

[4-a] Draw the following: (101) , $(1\bar{1}1)$, $(0\bar{1}\bar{1})$, $[110]$, $[\bar{1}11]$

[4-b] Define: Space lattice-Unit cell-Crystal systems-Coordination number-Miller indices.

[4-c] In X-ray diffraction experiment if the angle of the first order diffraction $\theta = 35^o$ and the wave length is $\lambda = 2.5\ A^o$. Calculate the distance d between planes

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[5-a] Explain the optical absorption and draw the band diagrams for:
i) intrinsic semiconductors ii) extrinsic semiconductors

[5-b] Findand draw the number of atoms per unit cell for the following: SC, BCC and FCC

[5-c] Calculate the inter-planer distance for:-
(100), (111) planes in a simple cubic with lattice constant of $4.2x10^{-10}$m.

[6-a] Define:- refractive index-direct and indirect band gap semiconductors-colour centers-excitons.

[6-b] Explain the physical origin of K,L and Mseries of X-ray.

[6-c] In Coolidge tube if the high tension voltage$V = 25\ KV$, calculate the velocity of the accelerated electrons v and if an electron looses all its energy calculate the frequency and wavelength of the produced X-ray.