CBCS SCHEME

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15PHY12/22

First/Second Semester B.E. Degree Examination, July/August 2021
Engineering Physics

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions.

2. Physical Constants: Velocity of light, $C = 3\times10^{8}$ m/S,
Plank's constant $h = 6.625\times10^{-34}$ J-S;
Mass of electron $m_e = 9.1\times10^{-31}$ kg,
Avogadro's number, $N_A = 6.023\times10^{-26}$ /Kmole
Boltzmann constant $K = 1.38\times10^{-23}$ J/K,
Charge of an electron $e = 1.602\times10^{-19}$ C

1 a. What is black body? Explain the spectral distribution of energy radiation emitted by the black body. **(06 Marks)**

b. What are Matter waves? Mention its characteristics properties? **(06 Marks)**

c. The uncertainty in the location of a particle is 1Å . Find the uncertainty in its momentum. **(04 Marks)**

2 a. Using Heisenberg's uncertainty principle. Prove that electron does not exist in the nucleus. **(05 Marks)**

b. Set up time independent Schrodinger wave equation for a particle in one – dimension using complex variables. **(06 Marks)**

c. Compare the energy of photon with that of a neutron when both are associated with a wavelength of 1Å (given that the mass of the neutron is 1.678×10^{-27}kg). **(05 Marks)**

3 a. Explain the terms :
i) Mean free path
ii) Relaxation time
iii) Drift velocity. **(06 Marks)**

b. Explain the success of Quantum free electron theory. **(06 Marks)**

c. For GaAS, the electrical conductivity at room temperature is 10^{-6}s/m. The electron and hole mobility are $0.85m^2/V.S$ and $0.04m^2V/S$ respectively. Calculate the intrinsic carrier concentration. **(04 Marks)**

4 a. What is Meissner effect? Explain Type – I and Type – II superconductors. **(07 Marks)**

b. Explain the BCS theory of superconductivity. **(05 Marks)**

c. Calculate the probability of finding an electron at an energy level 0.02 eV above the Fermi level of ambient temperature of 300K. **(04 Marks)**

5 a. Mention the condition and requisites for lasing action. **(06 Marks)**

b. Explain the construction and working principle of CO_2 gas laser. **(06 Marks)**

c. The refractive indices of the core and cladding of a step index optical fiber are 1.45 and 1.40 respectively and its core diameter is 50μm. Calculate the number of modes for the light of wavelength 670nm. **(04 Marks)**

6 a. Derive an expression for numerical aperture of an optical fiber placed in a Air medium. **(05 Marks)**

b. Describe the method of recording and reconstruction of an image in a holography with the help of suitable diagrams. **(06 Marks)**

c. What is Attenuation? Explain any two factors affecting the power loss. **(05 Marks)**

7 a. Define the terms :
i) Space lattice
ii) Poly morphism
iii) Allotropy
iv) Unit cell. **(06 Marks)**

b. What is Atomic Packing Factor (APF)? Calculate the atomic packing factor for simple cubic, Face centered cubic and BCC. **(06 Marks)**

c. Sketch the following planes in cubic unit cell i) (110) ii) $(\bar{1}10)$ iii) (213) and $(\bar{2}13)$. **(04 Marks)**

8 a. What is Primitive cell? Derive an expression for interplanner spacing in terms of Miller indices. **(06 Marks)**

b. Describe the Bragg's X-ray diffractometer used to determine the crystal system. **(06 Marks)**

c. A monochromatic x-ray beam of wavelength 700nm undergoes 2^{nd} order Bragg's reflection from a plan (302) of a cubic crystal at a glancing angle of 35°. Calculate the lattice constant. **(04 Marks)**

9 a. What are the shock waves? Mention its properties and applications. **(07 Marks)**

b. Give the graphical representation of density of states for 0D, 1D, 2D and 3D structures as a function of energy. **(04 Marks)**

c. Write a note on Carbon Nanotube (CNT). **(05 Marks)**

10 a. Define Machnumber and give distinctions between acoustics, ultrasonic, subsonic and supersonic waves. **(06 Marks)**

b. Describe the process of recording the image of sample using scanning electron microscope. **(06 Marks)**

c. The distance between the two pressures sensors in a shock wave tube 100mm the time taken by a shock wave to travel this distance is 0.2ns. Find the Mach number of the shock wave travelling at 330m/s. **(04 Marks)**

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