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14PHY12/22

First/Second Semester B.E. Degree Examination, Dec.2019/Jan.2020
Engineering Physics

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, selecting ONE full question from each module.***

Module-1

1 a. Derive an expression for group velocity on the basis of superposition of waves. **(06 Marks)**

b. On the basis of uncertainty principle prove that electrons cannot exist inside the nucleus of an atom. **(06 Marks)**

c. State deBroglie's hypothesis and obtain the expression for wavelength of matter wave. **(04 Marks)**

d. An electron is bound in one dimensional potential well of width 0.12 nm. Find the energy values in the ground state and first excited state in eV.
Given: Planck's constant, $h = 6.626 \times 10^{-34}$ J-S, mass of electron $m = 9.1 \times 10^{-31}$ kg, charge of electron $e = 1.6 \times 10^{-19}$ C. **(04 Marks)**

2 a. Assuming the time independent Schrodinger wave equation, obtain the expression for wave function of a particle in one dimensional potential well of infinite height. **(08 Marks)**

b. Obtain the relation between phase velocity and group velocity. **(04 Marks)**

c. Using Pranck's law of radiation obtain Wein's law and Raleigh-Jean's law. **(05 Marks)**

d. Calculate the deBroglie wavelength associated with 0.5 kg particle which moves with a speed of 6 ms^{-1}. Given: $h = 6.626 \times 10^{-34}$ JS. **(03 Marks)**

Module-2

3 a. Explain the variation of fermifactor with temperature and energy. **(06 Marks)**

b. Explain BCS theory of superconductors. **(04 Marks)**

c. In the case of intrinsic semiconductor show that the fermilevel lies exactly at the centre of forbidden gap. **(06 Marks)**

d. A copper specimen having length 1 meter, width 1 cm and thickness 1 mm is conducting 1 ampere current along its length and is applied with a magnetic field of 1 tesla along its thickness. It develops a Hall voltage of 0.074 microvolt along its width. Calculate the Hall coefficient. **(04 Marks)**

4 a. What is Hall effect? Obtain the expression for Hall voltage and Hall coefficient. **(07 Marks)**

b. Explain the two types of superconductors. **(06 Marks)**

c. Write the expression for electrical conductivity of conductors and density of states based on quantum theory and explain the terms. **(04 Marks)**

d. Write three important assumptions of quantum free electron theory. **(03 Marks)**

Module-3

5 a. Obtain an expression for energy density of radiation under equilibrium condition in terms of Einstein's coefficients. **(06 Marks)**

b. With neat diagrams explain different types of optical fibers. **(06 Marks)**

c. Describe the recording and reconstruction process in holography. **(05 Marks)**

d. The refractive indices of core and cladding are 1.50 and 1.48 respectively. Find the numerical aperture and angle of acceptance. **(03 Marks)**

6 a. Derive an expression for numerical aperture and arrive at the condition for light propagation. **(06 Marks)**

b. Describe the construction and working of semiconductor diode laser. **(06 Marks)**

c. A laser unit is emitting a beam with an average power of 4.5 mW. Find the number of photons emitted per second by the laser. The wavelength of the laser emitted is 6328 $\mathring{A}$. Given: Planck's constant, $h = 6.63 \times 10^{-34}$ JS, $C = 3 \times 10^{8}$ m/s. **(04 Marks)**

d. Write note on laser welding. **(04 Marks)**

Module-4

7 a. Derive the inter planar spacing in terms of Miller indices for cubic lattice. **(06 Marks)**

b. Calculate the coordination number of 3 types of cubic crystal structure. **(06 Marks)**

c. Derive Bragg's equation. **(05 Marks)**

d. Find the Miller indices of plane making intercepts 2a, 3b on x and y axis and parallel to z-axis, a and b are primitive vectors. **(03 Marks)**

8 a. Explain principle and working of LCD. **(06 Marks)**

b. Obtain the relation between atomic radius and the lattice constant in the case of body centered cubic system. Hence find out the corresponding packing factor. **(06 Marks)**

c. An x-ray beam of wavelength 0.7 $\mathring{A}$ undergoes minimum order Bragg reflection from the plane (3, 0, 2) of cubic crystal at glancing angle 35°. Calculate the lattice constant. **(05 Marks)**

d. With diagram, explain monoclinic crystal system. **(03 Marks)**

Module-5

9 a. What is Mach number? Based on this classify the compressible flow. **(06 Marks)**

b. With block diagram, explain the principle and working of Scanning Electron Microscope (SEM). **(07 Marks)**

c. What is carbon nano tube? Explain types and structure of carbon nano tubes. **(07 Marks)**

10 a. Explain conservation of mass in the case of shock wave and hence arrive at the continuity equation. **(06 Marks)**

b. What is a shock wave? Write any three applications. **(04 Marks)**

c. Explain Bottom-up approach to manufacture nano materials. Describe Sol-gel method as an example for it. **(10 Marks)**

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