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NEW SCHEME

First / Second Semester B.E. Degree Examination, July 2006
Common to All Branches
Engineering Physics

Time: 3 hrs.] [Max. Marks:100

Note: *1. Answer any FIVE questions.*

Electron mass=m=9.11× 10^{-31}kg, Electron charge=e=1.6×10^{-19}C, Velocity of light=C=3×10^{8}m/s, Planck's constant=h=6.63×10^{-34}J-S, Permittivity of vacuum= ε_0 =8.85×10^{-12}F/m, Avogadro's Number =NA=6.025×10^{26}/K.mole, Boltzman Constant=K=1.38×10^{-23}J/K

1 a. State de-Broglie hypothesis and derive an expression for de-Broglie wavelength using the concept of group velocity. **(06 Marks)**

b. Explain and deduce the expression for phase velocity and group velocity. Derive the relation between them. **(10 Marks)**

c. Calculate the de-Broglie wavelength associated with 400gm cricket ball with a speed of 90 Km/hr. **(04 Marks)**

2 a. Find Eigen values and Eigen functions for a particle in one dimensional potential well of finite width and infinite height. A quantum particle confined to one dimensional potential well of finite width is known to be in its first excited state. What is the probability that the particle will be anywhere in the central half of the box? **(12 Marks)**

b. Explain the BCS theory of superconductivity. **(04 Marks)**

c. Explain the working of SQUID. **(04 Marks)**

3 a. Elucidate the difference between classical free electron theory and quantum free electron theory. Describe how quantum free electron theory has been successful in overcoming the failures of classical free electron theory. **(09 Marks)**

b. Define Fermi factor and hence discuss the probability of occupation of various energy states by electrons at T = 0 K and T > 0 K **(07 Marks)**

c. Calculate the probability of an electron occupying an energy level 0.02 eV above the Fermi level at 200K and 400K in a material. **(04 Marks)**

4 a. What are ferrites? Discuss their properties and uses. **(05 Marks)**

b. Define electric polarization and static dielectric constant of materials and derive a relation between them. If a NaCl crystal is subjected to an electric field of 1000 V/m and the resulting polarization is 4.3×10^{-8} c/m^2, calculate the static dielectric constant of NaCl. **(10 Marks)**

c. What is dielectric loss? Derive an expression for dielectric loss. **(05 Marks)**

5 a. Explain the basic principles involved in laser action. **(06 Marks)**

b. Describe the construction and working principle of He-Ne gas laser. **(08 Marks)**

c. Explain 'Holography' principle and mention its applications. **(06 Marks)**

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6 a. With a neat diagram derive an expression for numerical apperture and condition for propagation in optical fiber. **(08 Marks)**

b. The attenuation of light in an optical-fiber is estimated as 2.2 dB/km. What fractional initial intensity remains after 2kms and 6kms? **(04 Marks)**

c. Describe the construction and working of Bragg's X-ray spectrometer and how it is used to determine the wave length of X-rays. **(08 Marks)**

7 a. Explain Miller indices. How to calculate packing fraction for bcc structure. **(08 Marks)**

b. Draw the following planes in a cubic unit cell $[132]$, $[1\bar{1}0]$, $[010]$, $[1\bar{2}1]$. **(08 Marks)**

c. With neat figure describe the structure of NaCl. **(04 Marks)**

8 a. Explain the advantages and disadvantages of composite materials. **(06 Marks)**

b. Explain the basic principles of quantum computation. **(06 Marks)**

c. What are smart materials? Explain the properties of smart materials. **(08 Marks)**

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