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14PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2018
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. What is Planck's Radiation Law? Explain how it overcomes the drawbacks of Wien's law and Rayleigh Jeans law. **(07 Marks)**

b. Show that the group velocity is same as particle velocity. **(04 Marks)**

c. What is a wave function? Give its physical significance. **(05 Marks)**

d. Calculate the value of difference in the energy of an electron in eV, bouncing back and forth between the second and third excited states of a path of 1 cm (Assume $h = 6.626\times10^{-34}$ J-S and mass of the electron = 9.1×10^{-31}kg). **(04 Marks)**

2 a. Explain the duality of matter waves. **(03 Marks)**

b. Explain Heisenberg's uncertainity principle. Based on this show that electrons donot present inside the nucleus. **(07 Marks)**

c. Apply time independent Schrodinger's wave equation to a particle in a potential well of infinite height and discuss the solutions. **(10 Marks)**

Module – 2

3 a. Briefly describe the Relaxation time and drift velocity. **(04 Marks)**

b. Show that the fermilevel in an intrinsic semiconductor has exactly halfway between conduction band and valence band. **(06 Marks)**

c. Discuss the different types of superconductors. **(06 Marks)**

d. Calculate the probability of finding the electron occupying an energy level 0.02 eV above fermilevel at 300 K in a material (Assume $K = 1.38\times10^{-23}$ J/K). **(04 Marks)**

4 a. What are the assumptions and success of quantum free electron theory? Explain one of them. **(06 Marks)**

b. What is Hall effect? Obtain the expression for Hall coefficient in terms of Hall voltage. **(07 Marks)**

c. Write a short note on Maglev vehicles. **(04 Marks)**

d. Calculate the conductivity of an intrinsic Ge Semiconductor having carrier concentration of $2.4\times10^{19}/m^3$, given the mobility of the electron as 0.39 m^2/v/s and the hole mobility as 0.19 m^2/v/s. Assume the charge of electron as 1.6×10^{-19}C . **(03 Marks)**

Module – 3

5 a. What are Einstein's coefficients? Obtain the expression for energy density of radiation under equilibrium conditions in terms of Einstein's coefficient. **(07 Marks)**

b. Describe briefly Laser welding and drilling processes. **(04 Marks)**

c. Calculate the refractive index of the core of an optical fiber having the cladding index 1.59 and numerical aperture of 0.2, when surrounded by a medium of refractive index 1.33. **(04 Marks)**

d. Describe the recording and reconstruction process of Holography. **(05 Marks)**

6 a. Describe the construction and working of CO_2 laser. (08 Marks)
b. Obtain the expression of Numerical Aperture interms of refractive indices. (06 Marks)
c. Discuss the different types of optical fibers. (06 Marks)

Module – 4

7 a. Obtain the expression for interplanar spacing interms of Miller indices for a cubic crystal. (06 Marks)
b. Define Atomic packing factor. Calculate the atomic packing factor for BCC. (04 Marks)
c. Define Allotrophy and polymorphism with an example. (04 Marks)
d. Discuss qualitatively the structure of Pervoskite. (06 Marks)

8 a. Describe how Bragg's X-ray spectrometer is used for the determination of crystal structur (10 Marks)
b. Explain the working of Liquid Crystal Display. (06 Marks)
c. Find the Miller indices of a set of parallel planes which make intercepts on X and Y axes $\frac{a}{3}$ and $\frac{b}{4}$ respectively and parallel to z-axes, where a, b and c are being the primitiv vectors of the lattice. (04 Marks)

Module – 5

9 a. Explain the construction and working of Reddy shock Tube. (08 Marks)
b. Discuss the Ball-Milling and Sol-Gel method of synthesis of nano-materials and mention advantages. (08 Marks)
c. Write a short note on Carbon Nanotubes. (04 Marks)

10 a. What is Mach Number? Distinguish between acoustic, ultrasonic, subsonic and superson waves. (08 Marks)
b. What are shock waves? List out few applications. (04 Marks)
c. Describe the principle, construction and working of scanning electron microscope. (08 Marks)

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