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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  $h = 6.626 \times 10^{-34}$  J-S and mass of the electron =  $9.1 \times 10^{-31}$  kg). (04 Marks)
- 2
  - a. Explain the duality of matter waves. (03 Marks)
  - b. Explain Heisenberg's uncertainty principle. Based on this show that electrons do not 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 fermi level 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 fermi level at 300 K in a material (Assume  $K = 1.38 \times 10^{-23}$  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  $2.4 \times 10^{19} / m^3$ , 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  $1.6 \times 10^{-19} C$ . (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)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 6 a. Describe the construction and working of CO<sub>2</sub> laser. (08 Marks)  
b. Obtain the expression of Numerical Aperture in terms 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 in terms 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 Allotropy and polymorphism with an example. (04 Marks)  
d. Discuss qualitatively the structure of Perovskite. (06 Marks)
- 8 a. Describe how Bragg's X-ray spectrometer is used for the determination of crystal structure. (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 as  $\frac{a}{3}$  and  $\frac{b}{4}$  respectively and parallel to z-axis, where a, b and c are being the primitive 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 its 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 supersonic 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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