CBCS SCHEME

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17PHY12/22

First/Second Semester B.E. Degree Examination, July/August 2022
Engineering Physics

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***

2. ***Physical constants : Velocity of light, $C = 3 \times 10^8$ m/s***
Planck's constant, $h = 6.63 \times 10^{-34}$ JS
Mass of electron, $m = 9.1 \times 10^{-31}$ kg
Charge of electron, $e = 1.6 \times 10^{-19}$ C
Boltzmann constant, $K = 1.38 \times 10^{-23}$ JK
Avagadro number, $N_A = 6.02 \times 10^{26}$/Kmole

Module-1

1 a. State Planck's radiation law. Show how Planck's law can be reduced to Wein's law and Rayleigh-Jean's law. **(07 Marks)**

b. State Heisenberg's uncertainty principle and show that electron does not exist inside the nucleus of an atom. **(06 Marks)**

c. Mention the properties of Matter waves. **(04 Marks)**

d. A particle of mass 0.5 MeV/C^2 has kinetic energy of 100 eV. Find its deBroglie wavelength. **(03 Marks)**

OR

2 a. Using Schrodinger's time independent wave equation, obtain eigen values and eigen functions for a particle in a one dimensional potential well of infinite height. **(07 Marks)**

b. Define phase velocity and group velocity. Show that group velocity is equal to particle velocity. **(06 Marks)**

c. Mention the properties of wave function. **(04 Marks)**

d. Calculate the wavelength associated with an electron raised to a potential of 2 kV. **(03 Marks)**

Module-2

3 a. What is Fermi Energy? Discuss the probability of occupation of various energy states by electron, on the basis of Fermi Factor. **(07 Marks)**

b. Explain Type I and Type II superconductors. **(04 Marks)**

c. Mention the failures of Classical Free Election Theory. **(06 Marks)**

d. If the mobility of electrons is 7×10^{-3} m^2/VS and the applied electric field is 1 Volt/cm. What is the drift velocity? **(03 Marks)**

OR

4 a. Explain the law of mass action and derive the expression for electrical conductivity of a semiconductor. **(07 Marks)**

b. Explain the success of Quantum Free Electron Theory. **(06 Marks)**

c. Explain the BCS Theory of Superconductivity. **(04 Marks)**

d. Calculate the probability of finding an electron at an energy level 0.02 eV above Fermi level at 200 K. **(03 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.

Module-3

5 a. Describe construction and working of carbon dioxide laser with suitable diagram. (07 Marks)

b. Explain with neat diagrams, the types of optical fibers. (06 Marks)

c. What is Holography? Mention any three applications of Holography. (04 Marks)

d. The ratio of population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted at 330 K. (03 Marks)

OR

6 a. Derive an expression for energy density of radiation interms of Einstein's coefficient. (07 Marks)

b. What is Numerical Aperture? Obtain an expression for Numerical Aperture interms of refractive indices of core and cladding. (06 Marks)

c. Mention any four applications of LASERs. (04 Marks)

d. The attenuation of light in an optical fiber is 3.6 dB/km, what fraction of its initial intensity remains after (i) 1 km and (ii) 3 km. (03 Marks)

Module-4

7 a. Describe briefly Seven Crystal Systems. (07 Marks)

b. Describe the construction and working of Bragg's X-ray spectrometer. (06 Marks)

c. What are Miller indices of planes? Describe the method of finding the same with an example. (04 Marks)

d. First order spectrum is found when X-rays of wavelength 1.5 $\mathring{A}$ is incident on a crystal at 12°. Calculate the inter-planar spacing of the crystal. (03 Marks)

OR

8 a. Define coordination and atomic packing factor. Calculate the atomic packing factor for bcc and fcc structures. (07 Marks)

b. What is Bravais lattice? Obtain an expression for interplanar spacing in terms of Miller Indices for a cubic system. (06 Marks)

c. Derive equation for Bragg's law. (04 Marks)

d. Draw the following Miller planes:

(i) (100) (ii) (112) (iii) $(1\ \bar{1}\ 0)$ (03 Marks)

Module-5

9 a. What are nano materials? Explain sol-gel method of synthesis of nano-materials. (07 Marks)

b. Explain Mach number. Distinguish between acoustic, ultrasonic, subsonic and supersonic waves. (06 Marks)

c. Mention any four applications of shock waves. (04 Marks)

d. What is a carbon nanotube? Mention any two applications of CNT. (03 Marks)

OR

10 a. What is a shock wave? Describe the construction and working of Reddy's shock tube. (07 Marks)

b. Explain the construction and working of Scanning Electron Microscope. (06 Marks)

c. Mention any four applications of nano materials. (04 Marks)

d. Explain Top-down approach for the preparation of nano materials in brief with relevant diagrams. (03 Marks)

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