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 Å 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)**

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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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