CBCS SCHEME

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17PHY12/22

First/Second Semester B.E. Degree Examination, Jan./Feb. 2021
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, $m_e = 9.1 \times 10^{-31}$ kg
Charge on electron, $e = 1.6 \times 10^{-19}$ C
Boltzmann constant $= 1.38 \times 10^{-23}$ JK^{-1}
Avagadro number $= 6.02 \times 10^{26}$/kmol

Module-1

1 a. What is ultra violet catastrophe? Deduce Planck's law of radiation to Wien's law and Rayleigh Jeans law. **(06 Marks)**

b. State Heisenberg's uncertainty principle. Prove that electron cannot exist inside the nucleus. **(06 Marks)**

c. Explain the physical significance of wave function. **(04 Marks)**

d. Calculate the momentum of an electron and the de Broglie wavelength associated with it if its kinetic energy is 1.5 KeV. **(04 Marks)**

OR

2 a. Derive the expression for time independent one dimensional Schrodinger wave equation. **(06 Marks)**

b. Define group velocity and phase velocity. Arrive at the relation between group velocity and phase velocity. **(06 Marks)**

c. Explain Compton effect and its physical significance. **(04 Marks)**

d. An electron is confined in a one dimensional infinite potential well of width 2 Å. Calculate its energy in ground and first excited state. **(04 Marks)**

Module-2

3 a. State law of mass action. Obtain an expression for electrical conductivity of intrinsic semiconductors. **(06 Marks)**

b. What is Fermi Energy? Explain the variation of Fermi factor with temperature and energy. **(07 Marks)**

c. What is critical field? Discuss temperature dependence of critical field in superconductors. **(03 Marks)**

d. Calculate the relaxation time of conduction electrons in a metal of resistivity 1.54×10^{-8} Ω-m if the metal has 5.8×10^{28} conduction electrons per m^3. **(04 Marks)**

OR

4 a. What are superconductors? Explain the BCS theory of Superconductivity. **(06 Marks)**

b. Discuss the failures of classical free electron theory. **(06 Marks)**

c. Explain MAGLE V vehicles. **(04 Marks)**

d. The electron concentration in an n-type semiconductor is $5 \times 10^{17}/m^3$. Calculate the conductivity of the material if the drift velocity of electron is 350 m/s in an electric field of 1000 V/m. **(04 Marks)**

Module-3

5 a. Describe the construction of semiconductor diode laser and explain its working. **(06 Marks)**

b. Discuss point to point communication with neat block diagram. **(04 Marks)**

c. Explain three different types of losses in optical fiber. **(06 Marks)**

d. A laser operating at 632.8 nm emits 3.182×10^{16} photons per second. Calculate the output power of the laser. If the input power is 100 Watt, calculate the percentage power converted into coherent light energy. **(04 Marks)**

OR

6 a. Obtain an expression for numerical aperture of an optical fibre and arrive at the condition for propagation of a signal in an optical fibre. **(06 Marks)**

b. What is Holography? Explain the recording and reconstruction of hologram with suitable ray diagram. **(07 Marks)**

c. Explain LIDAR used in the measurement of pollutants in the atmosphere. **(03 Marks)**

d. Calculate the attenuation in an Optical fibre of length 500 m, when a light of signal of power 100 mW emerges out of the fiber with a power 90 mW. **(04 Marks)**

Module-4

7 a. What are Miller indices? Derive an expression for interplanar distance interms of Miller indices. **(05 Marks)**

b. Explain in brief the seven crystal systems with lattice parameters and necessary figures. **(07 Marks)**

c. Define primitive and non-primitive cell. Mention types of unit cell. **(04 Marks)**

d. Calculate the density of diamond, given that the cube edge of its unit cell is 3.57 $\mathring{A}$ and the atomic weight of carbon is 12.01. **(04 Marks)**

OR

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

b. Explain the crystal structure of diamond with neat diagram and calculate its atomic packing factor. **(06 Marks)**

c. Explain Allotropy and polymorphism with examples. **(04 Marks)**

d. Draw the following planes in cubic unit cell: (1 1 1) (2 0 2) (1 2 T) and (0 T 1) **(04 Marks)**

Module-5

9 a. Discuss the variation of density of energy states for 3D, 2D, 1D and 0D structures. **(06 Marks)**

b. Describe the construction and working of Reddy shock tube. **(06 Marks)**

c. Explain ball milling method to produce nanoparticles. **(04 Marks)**

d. What are shock waves? Mention any three applications of shock waves. **(04 Marks)**

OR

10 a. Describe the principle, construction and working of scanning electron microscope. **(07 Marks)**

b. Explain pyrolysis method of obtaining carbon nanotubes. **(05 Marks)**

c. Distinguish between subsonic and supersonic waves. **(04 Marks)**

d. Mention Rankine-Hugoniot equations for shock waves. **(04 Marks)**

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