CBCS SCHEME

USN | | | | | | | | | | |

17PHY12/22

First/Second Semester B.E. Degree Examination, Feb./Mar. 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, $h = 6.625 \times 10^{-34}$ JS
Boltzmann's constant, $k = 1.38 \times 10^{-23}$ J/k
Avagdro's no, $N_A = 6.023 \times 10^{26}$/Kmole
Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg
Mass of neutron, $m_n = 1.675 \times 10^{-27}$ kg
Charge of electron = 1.6×10^{-19} C.

Module-1

1 a. Describe the assumptions of Planck's law of Black-body radiation. Show that this law can be reduced to Wien's law and Rayleigh law under certain condition. **(06 Marks)**

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

c. Using Heisenberg uncertainty principle show that electron do not exists inside the nucleus. **(06 Marks)**

d. An electron is bound in one dimensional potential well of width 2 Å, but of infinite height. Find its energy value in 'eV' in the ground state and first two excited state. **(04 Marks)**

OR

2 a. Define group velocity. Establish that group velocity of the de-Broglie's wave of a particle is equal the velocity of particle. **(05 Marks)**

b. Define wave function. Explain its physical significance. **(04 Marks)**

c. Obtain energy eigen value and eigen function for an electron in one dimensional potential well of width 'a' and infinite height using one dimensional time independent Schrodinger wave equation. **(08 Marks)**

d. Calculate the de-Broglie wavelength associated with electron accelerated through a potential difference of 1.5eV. **(03 Marks)**

Module-2

3 a. Define relaxation time and density of states. **(04 Marks)**

b. Derive the expression for electrical conductivity taking into account the quantum theory of free electron. **(08 Marks)**

c. Explain superconductivity and discuss Meissner effect. **(05 Marks)**

d. If the mobilities of electron and holes in an intrinsic semiconductor at 300K are 0.36 and 0.14m^2/v-s respectively. Calculate the roof intrinsic charge carriers present in it, given conductivity (σ) = 2.2/ohm-m. **(03 Marks)**

OR

4 a. Describe the merits of quantum free electron theory. **(06 Marks)**

b. State law of mass action. Derive the expression for conductivity of an intrinsic semiconductor. **(05 Marks)**

c. Define type I and type II superconductors. Mention its application. **(06 Marks)**

d. Calculate the relaxation time of conduction electrons in a metal of resistivity 1.92×10^{-8} ohm-m, if the metal contains 5.8×10^{28}es/m^3. **(03 Marks)**

Module-3

5 a. Explain the terms population inversion and metastable state for achieving laser beam. **(04 Marks)**

b. Explain the different vibrational state of CO_2 molecules. Describe the construction and working of CO_2 laser. **(08 Marks)**

c. With neat diagram obtain the expression for numerical aperture and condition for propagation of light in an optical fibre. **(05 Marks)**

d. Calculate V-number R-Number of modes for a fiber of core diameter 50μm with refractive indices 1.50 and 1.48 respectively for core and cladding. The wavelength of the light propagating through fibre is 1μm. **(03 Marks)**

OR

6 a. Write a brief note on laser welding, cutting and drilling. **(06 Marks)**

b. With neat sketch describe the types of optical fibre. **(06 Marks)**

c. Derive the expression for attenuation coefficient of an optical fibre. **(04 Marks)**

d. The average power of laser beam of wavelength is 6328 Å is 8mW. Find the number of photons emitted per second by the source. **(04 Marks)**

Module-4

7 a. Obtain the expression for interplanar spacing in a crystal interms of Miller indices. **(06 Marks)**

b. With neat diagram, explain the structure of a diamond crystal. **(06 Marks)**

c. Draw the following planes:

i) (0 1 0) ii) (0 2 1) iii) (1 1 1) iv) $(\bar{2}\,1\,0)$ **(04 Marks)**

d. Find the miller indices of the plane making an intercept of $6\vec{a} : 5\vec{b} : 8\vec{c}$ on x:y:z axis. Where $\vec{a}, \vec{b}$ and $\vec{c}$ are primitive vector. **(04 Marks)**

OR

8 a. Define:

i) Unit cell and lattice parameter

ii) Bravis and Non-Bravis lattice

iii) Primitive and non primitive unit cell with neat figure. **(06 Marks)**

b. Obtain packing factor of sc, bcc and fcc structure after obtaining the relation between lattice constant 'a' and atomic radius 'R'. **(06 Marks)**

c. Define Miller indices and explain the procedure to find it. **(04 Marks)**

d. Calculate the glancing angle of incidence of x-rays of wavelength 0.58 Å on the plane (132) of NaCl, which results in 2nd order diffraction maxima, taking the lattice constant as 3.81 Å. **(04 Marks)**

Module-5

9 a. Define Mach number. Explain the basic laws of conservation of mass, momentum and energy. **(07 Marks)**

b. Discuss the density of states in 1D, 2D and 3D structures. **(06 Marks)**

c. Explain carbon nanotube and its structure. Mention few applications of it. **(07 Marks)**

OR

10 a. Discuss shock wave. Distinguish between acoustic, ultrasonic, subsonic and supersonic waves. **(06 Marks)**

b. With neat diagram describe the hand operated Reddy shock tube and its characteristics. **(08 Marks)**

c. Describe top down and Bottom-up approach for the synthesis of nano-particles. Discuss ball-milling method. **(06 Marks)**

* * * * *