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10PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2016
Engineering Physics

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, choosing at least two from each part.***
2. ***Answer all objective type questions only on OMR sheet page 5 of the answer booklet.***
3. ***Answer to objective type questions on sheets other than OMR will not be valued.***
Physical Contants : $h = 6.625 \times 10^{-34} Js$, $C = 3 \times 10^{8} m/s$, $E = 1.6 \times 10^{-19} C$, $K = 1.38 \times 10^{-23} JK^{-1}$, $\epsilon_0 = 8.854 \times 10^{-12} Fm^{-1}$.

PART – A

1 a. Choose the correct answers for the following : **(04 Marks)**

i) With increase in temp of black body radiation maximum intensity position shifts towards
A) Shorter wavelength B) Larger wave length
C) No change D) None of these

ii) Green light incident on a surface releases photoelectrons from the surface. If the blue light is incident on the same surface the velocity of electrons.
A) Increases B) Decreases C) Remains same D) Becomes zero

iii) The group velocity of the particle is 3×10^6m/s, whose phase velocity is
A) 6.06×10^6 m/s B) 3×10^{10} m/s C) 3×10^6 m/s D) 1.5×10^{10} m/s

iv) Electron behaves as wave, because they can be
A) Deflected by Electric field B) Deflected by magnetic field
C) Diffracted by crystals D) Ionize a gas

b. Describe Davison and Germer's experiment for the justification of de – Broglie wave length. **(06 Marks)**

c. Derive an expression for de – Broglie wavelength using the concept of group velocity. **(06 Marks)**

d. A particle of mass 0.5 mev/C^2 has kinetic energy 100eV. Find its de-Broglie wavelength where 'C' is the velocity of light. **(04 Marks)**

2 a. Choose the correct answers for the following : **(04 Marks)**

i) The uncertainty in the determination of position of an electron is $\left(\frac{h}{3\pi}\right)$, then the uncertainty in the determinations of its momentum is
A) $\frac{1}{4}$ B) $\frac{4}{3}$ C) $\frac{3}{4}$ D) 3

ii) If the electron exists in a nucleus, its energy must have a minimum energy of about
A) 4 Mev B) 10 Kev C) 20 Kev D) 20 Mev

iii) Wave function is an acceptable wave function, if it is
A) Finite every where B) Continuous every where
C) Single valued everywhere D) Having all these properties.

iv) The normalization of wave function is always possible if

A) $\int_{-\infty}^{\infty} \psi^* dx = \text{infinite}$ B) $\int_{-\infty}^{\infty} \psi^* dx = \text{finite}$ C) $\int_{-\infty}^{-\infty} \psi^* dx = 0$ D) All of these

b. State and explain Heisenberg's uncertainty principle. **(04 Marks)**

c. Solve the Schrodinger wave equations for allowed energy values in case of a particle in a potential box of infinite height. **(08 Marks)**

d. Estimate the time spent by an atom in the excited state during the excitation and deexcitation processes, when a spectral line of wavelength 546nm and width 10-5nm is emitted. **(04 Marks)**

3 a. Choose the correct answers for the following : **(04 Marks)**

i) For ordinary metals, the resistivity versus temperature curve at OK

A) has a positive intercept B) has a negative intercept
C) goes through the origin D) None of these

ii) Mobility of electron is

A) Reciprocal of conductivity B) Flow of electrons per unit time
C) Reciprocal of resistivity
D) Average electron drift velocity/unit electric field.

iii) Average drift velocity Vd of electrons in a metal is related to the electric field and collision time τ.

A) $\sqrt{\frac{m}{eE\tau}}$ B) $\frac{eE\tau}{m}$ C) $\sqrt{\frac{eE\tau}{m}}$ D) $\frac{m}{eE\tau}$

iv) The Fermi energy of a metal at absolute zero temperature is proportional to

A) $n^{1/3}$ B) $n^{3/2}$ C) $n^{2/3}$ D) n^2

b. Using free electrons theory derive an expression for electrical conductivity in metals. **(06 Marks)**

c. Explain how quantum free electron theory succeeds on overcoming the drawbacks of classical free electron theory. **(06 Marks)**

d. Calculate the probability of an electron occupying an energy level 0.02ev above the fermi level at 200K and 400K in a material. **(04 Marks)**

4 a. Choose the correct answers for the following : **(04 Marks)**

i) When a dielectric material is subjected to an external electric field, the internal field will be

A) lesser than the applied field B) greater than the applied field
C) same as the applied field D) Zero

ii) The energy due to dielectric loss appears as

A) light energy B) heat energy
C) sound energy D) electromagnetic energy

iii) Piezoelectric effect is the production of energy by

A) chemical effect B) varying field C) temperature D) pressure

iv) For Ferro magnetic substance, the Curie – Weirs law is given by

A) $\Psi = \frac{C}{T}$ B) $\Psi = \frac{T-\theta}{C}$ C) $\Psi = \frac{C}{T-\theta}$ D) $\Psi = \frac{C}{T+\theta}$

b. Define Dielectric Polarizations. Discuss any three types of polarization mechanism in dielectrics. **(07 Marks)**

c. Distinguish between Hard & soft magnetic materials. **(05 Marks)**

d. A solid dielectric material has electronic polarizability 7×10^{-40} F m^2. If it is a cubic structure, calculate the relative permittivity of the materials. It has 3×10^{28} atoms/m^3. **(04 Marks)**

PART - B

5 a. Choose the correct answers for the following : **(04 Marks)**

i) The relation between Einstein's coefficients A and B is

A) $\frac{8\pi h\lambda^3}{C^3}$ B) $\frac{8\pi h^2\gamma^3}{C^3}$ C) $\frac{8\pi h\gamma^3}{C^3}$ D) $\frac{8\pi h\gamma^3}{C^2}$

ii) Condition for lasing action is

A) Excitations B) Absorption C) Emission D) Population inversion

iii) Pumping process in Ga As laser is by

A) Optical pumping B) Forward bias

C) Electric discharge D) None of these

iv) In recording the image on the photographic plate, the reference beam and the object beam undergo _____ at the photographic plate

A) Interference B) Diffraction C) Dispersion D) None of these

b. Discuss the possible ways through which radiation and matter interaction takes place. **(06 Marks)**

c. Describe the construction and working of He – Ne laser with the help of energy level diagram. **(06 Marks)**

d. A medium in thermal equilibrium at temperature 300K has two energy levels with a wavelength separation 1μm. Find the ratio of densities of the upper and lower levels. **(04 Marks)**

6 a. Choose the correct answers for the following : **(04 Marks)**

i) Fractional index change for an optical fiber with core and cladding refractive indices 1.563 and 1.498 respectively is

A) 0.00415 B) 0.04159 C) 0.04300 D) 0.00400

ii) In graded index fiber the refractive index of the core varies

A) Linearly B) Parabolic manner C) exponential manner D) None of these

iii) The critical field strength of a superconductor

A) is inversely proportional to temperature B) is proportional to temperature

C) varies with temperature D) is independent of temperature

iv) The phase transition from superconducting to normal state can be effected by means of Meissner effect. This principle can be used in

A) switching devices B) measuring technology

C) NMR tomography D) Bubble chambers

b. Describe Type – I and Type – II super conductors. **(05 Marks)**

c. What is numerical aperture? Obtain an expression for numerical aperture and obtain the condition for propagation in optical fiber. **(07 Marks)**

d. The attenuation of light in an optical fiber is 3.6 dB/km. What fractional intensity remains after 1km and 2km? **(04 Marks)**

7 a. Choose correct answers for the following : **(04 Marks)**

i) The coordination number incase of FCC is

A) 6 B) 8 C) 12 D) 16

ii) The relation between lattice constant 'a' and atomic radius 'r' in case of BCC structure is

A) $a = \sqrt{2}\,r$ B) $a = \frac{4}{\sqrt{3}}r$ C) $a = 2\sqrt{2}\,r$ D) $a = 2r$

iii) In a cubic crystal a plane make interrupts 1, -3, 1 on the X, Y and Z axes respectively. The miller indices of the plane are

A) $(\bar{3}\ 1\ \bar{3})$ B) $(3\ \bar{1}\ 3)$ C) $(1\ \bar{3}\ 1)$ D) $(\bar{1}\ 3\ \bar{1})$

iv) The packing fraction of diamond crystal structure is

A) 34% B) 52% C) 68% D) 74%

b. Derive an expression for interplanar spacing interms of miller indices. **(05 Marks)**

c. Explain in brief the seven crystal system with neat diagram. **(07 Marks)**

d. A beam of X -- rays of wavelength 0.071nm is diffracted by (110) plane of rock salt with lattice constant of 0.28nm. Find the glancing angle for the second order diffraction. **(04 Marks)**

8 a. Choose the correct answers for the following : **(04 Marks)**

i) Bulk material reduced in two directions is known as

A) quantum dot B) quantum particle C) film D) quantum wire

ii) Fullerene is

A) A sheet of carbon atoms rolled up into long tube

B) Sixty carbon atoms arranged in the shape of a foot ball

C) One dimensional array of atoms D) Three dimensional array of atoms.

iii) The elastic behaviour of a liquid is characterized by its

A) Young's modulus B) Modulus of rigidity

C) Bulk modulus D) Poisson's ratio

iv) A constant testing of product with out carrying any damage is called

A) Minute testing B) Destructive testing

C) Non destructive testing D) Random testing.

b. What are Nanomaterials? Explain carbon nanotunes and their applications by giving their physical properties. **(08 Marks)**

c. Explain the principle and method of non destructive method of testing of materials using ultrasonic's. **(08 Marks)**

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