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

06PHY12/22

NEW SCHEME

I/II Semester B.E. Degree Examination, Dec.06 / Jan.07
Common to all Branches
Engineering Physics

Time: 3 hrs.] [Max. Marks:100

Note: *1. Answer any FIVE questions choosing at least two questions from each part*

List of Constants:

i) Velocity of light $C = 3 \times 10^8$ m/s.
ii) Planck's constant $= h = 6.626 \times 10^{-34}$ Js.
iii) Mass of neutron $= 1.67 \times 10^{-27}$ kg.
iv) Boltzmann constant $= 1.38 \times 10^{-23}$ J/K.
v) Electron mass $= 9.11 \times 10^{-31}$ kg.
vi) Electrons charge $= 1.6 \times 10^{-19}$ C.
vii) $\in_0$ permittivity of vacuum $= 8.85 \times 10^{-12}$ Fm^{-1}.

Part A

1 a. Discuss Planck's radiation law. **(05 Marks)**

b. Explain the duality of matter waves from the inferences drawn from photoelectric effect and Davisson-Germer effect. **(05 Marks)**

c. Define group velocity and obtain an expression for the same. **(05 Marks)**

d. A particle of mass 0.5 Mev/C^2 has kinetic energy 100 ev. Find its de-Broglie wavelength, where C is the velocity of light. **(05 Marks)**

2 a. Show that electrons cannot exist in the nucleus of an atom. **(07 Marks)**

b. An electron has a speed of 6×10^5 m/s with an inaccuracy of 0.01%. With what fundamental accuracy can we locate the position of the electron? **(05 Marks)**

c. Discuss the wave functions, probability densities and energy levels for a particle in a box. **(08 Marks)**

3 a. State Mathiessien's rule and give an account of the nature of total resistivity both at high and low temperatures. **(05 Marks)**

b. Using the free electron model derive an expression for electrical conductivity in metals. **(07 Marks)**

c. Explain density of states. **(03 Marks)**

d. Calculate the drift velocity and thermal energy of electrons in a metal of thickness 1 mm across which a potential difference of 1 volt is applied, at the temperature of 300 K. The mobility of free electron is 40 cm^2/v-s. **(05 Marks)**

4 a. Explain briefly the various types of polarization. **(08 Marks)**

b. Derive an expression for internal field in case of liquids and solids. **(08 Marks)**

c. What is the polarization produced in sodium chloride by an electric field of 600 v/mm if it has a dielectric constant of 6? **(04 Marks)**

Contd....2

Part B

5 a. Explain with sketches the basic principle of operation of lasers. **(08 Marks)**

b. Describe the construction and working of He-Ne laser, with energy level diagram. **(08 Marks)**

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

6 a. Explain in brief Type-I and Type-II super conductors. How does a super conductor differ from a normal conductor? **(10 Marks)**

b. What is attenuation in an optical fibre? Explain the attenuation mechanisms. **(05 Marks)**

c. The attenuation of an optical fibre is -3.6 dB/km. What is the fraction of light intensity that remains after i) 1 km ii) after 3 km? **(05 Marks)**

7 a. Define crystal lattice, unit cell and primitive cell. **(06 Marks)**

b. What is atomic packing factor? Work out atomic packing factors for simple cubic, FCC and BCC structures. **(10 Marks)**

c. Calculate the glancing angle on the cube (132) of NaCl, having lattice spacing 3.81A°, corresponding to the second order diffraction for x-rays of wavelength 0.58A°. **(04 Marks)**

8 a. What are nanomaterials? Write a note on carbon nanotubes. **(06 Marks)**

b. What is non-destructive testing? Explain with principle how flow in a solid can be detected by non-destructive method using ultrasonics? **(07 Marks)**

c. Explain "scaling laws". Explain scaling of classical mechanical systems along with two examples and the assumptions involved in it. **(07 Marks)**

*****

06PHY12/22

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

First / Second Semester B.E. Degree Examination, July 2007
Common to all Branches
Engineering Physics

Time: 3 hrs.] [Max. Marks:100

Note : ***Answer any FIVE full questions choosing atleast two questions from each part.***

List of constants:

1. ***Velocity of light*** $C = 3 \times 10^8$ ***m/s.***
2. ***Plank's constant*** $h = 6.626 \times 10^{-34}$ ***Js.***
3. ***Mass of neutron*** $= 1.67 \times 10^{-27}$ ***kg.***
4. ***Boltzman constant*** $= 1.38 \times 10^{-23}$ ***J/K.***
5. ***Electron mass*** $= 9.11 \times 10^{-31}$ ***kg.***
6. ***Electron's charge*** $= 1.6 \times 10^{-19}$ ***C.***
7. ϵ_0 ***permittivity of vacuum*** $= 8.85 \times 10^{-12}$ Fm^{-1}.

Part A

1 a. Give a brief account of black body radiation and Plank's radiation law, leading to quantization of energy. **(04 Marks)**

b. Explain phase velocity, group velocity and particle velocity and write down the relation between them. **(06 Marks)**

c. From the concept of group velocity, obtain an expression for De'Broglie wavelength. **(06 Marks)**

d. Calculate the De'Broglie wavelength of a 0.3 kg cricket ball with a speed of 120 km/hr. **(04 Marks)**

2 a. What are the properties of wave functions? **(04 Marks)**

b. Find the eigen functions and eigen values for a particle in one dimensional potential well of infinite height and discuss the solutions. **(11 Marks)**

c. A spectral line of wavelength 4000 $\mathring{A}$ has a width of 8×10^{-5} $\mathring{A}$. Evaluate the minimum time spent by the electrons in the upper energy state between the excitation and deexcitation processes. **(05 Marks)**

3 a. Elucidate the difference between classical free electron theory and quantum free electron theory. **(06 Marks)**

b. Explain Fermi energy and Fermi factor. Discuss the variation of Fermi factor with temperature and energy. **(08 Marks)**

c. Find the relaxation time of conduction electrons in a metal of resistivity $1.54 \times 10^{-8}\Omega$-m, if the metal has 5.8×10^{28} conduction electrons per m^3. **(06 Marks)**

Contd....2

Part B

4 a. Derive the equation for internal field in liquid and solids. **(08 Marks)**

b. The atomic weight and density of sulphur are 32 and 2.08×10^3 kg/m^3 respectively. The electronic polarizability of the atom is 3.28×10^{-40} F-m^2. If sulphur solid has cubic structure, calculate its dielectric constant. **(04 Marks)**

c. Distinguish between hard and soft magnetic materials. **(08 Marks)**

5 a. What are semiconductor diode lasers? Describe with energy band diagram the construction and working of semiconductor diode laser. Mention the uses of diode lasers. **(10 Marks)**

b. Describe briefly the application of lasers in welding, cutting and drilling. Mention the nature and property of the lasers used. **(06 Marks)**

c. Find the number of modes of the standing waves and their frequency separation in the resonant cavity of length 1 m of He-Ne laser operating at wavelength 632.8 nm. **(04 Marks)**

6 a. Describe how Cooper pairs are formed and explain the salient features of super conductivity. **(05 Marks)**

b. Explain the mechanism of light propagation in optical fibre. Discuss the different types of optical fibres with suitable diagrams. **(10 Marks)**

c. Calculate the number of modes an optical fibre can transmit, given the following data: wavelength of light = 1 μm, radius of the core = 50 μm, Refractive index of the core = 1.50, Refractive index of the cladding 1.48. **(05 Marks)**

7 a. Define lattice points, bravais lattice and primitive cell. Explain in brief the seven crystal systems with neat diagrams. **(10 Marks)**

b. Explain with neat sketch the diamond crystal. **(04 Marks)**

c. Explain how Braggs X-ray spectrometer can be used to determine the interplanar spacing. **(06 Marks)**

8 a. Write a brief note on
   i) Nanotechnology.
   ii) Carbon nanotubes. **(06 Marks)**

b. What are ultrasonic waves? Describe a method of measuring the velocity of ultrasonic waves in solids. **(07 Marks)**

c. What is an acoustic grating? Explain how an acoustic grating is used to determine the velocity of ultrasonic waves in liquid. Also mention how the bulk modulus of a liquid can be evaluated. **(07 Marks)**

*****

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

06PHY12/22

First/Second Semester B.E Degree Examination, Dec. 07 / Jan. 08
Engineering Physics

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions choosing atleast TWO questions from each part.***

List the contents: i) Velocity of light $C = 3\times10^{8}$ m/s, ii) Planck's constant $h = 6.626\times10^{-34}$ J.s, iii) Boltzman constant $K = 1.38\times10^{-23}$ J/K, iv) Electron mass $m = 9.11\times10^{-31}$ kg. v) Electron charge $e = 1.6\times10^{-19}$C, vi) Permittivity of vacuum $\epsilon_0 = 8.85\times10^{-12}$ F/m

PART - A

1 a. Explain the energy distribution in the spectrum of a block body. Give an account of the attempts made through various laws to explain the spectrum. **(08 Marks)**

b. Define phase velocity and group velocity. Derive an expression for de-Broglie wavelength from group velocity. **(07 Marks)**

c. A particle of mass $0.65\text{MeV}/C^2$ has a kinetic energy 80eV. Calculate the deBroglie wavelength, group velocity and phase velocity of the deBroglie wave. **(05 Marks)**

2 a. Assuming the time independent Schrodinger wave equation, discuss the solution for a particle in one dimensional potential well of infinite height. Hence obtain the normalized wave function. **(08 Marks)**

b. Explain Heisenberg's uncertainty principle. Based on this, show the non-existence of electrons inside the nucleus. **(07 Marks)**

c. An electron is bond in one dimensional potential well of width 0.12nm. Find the energy values in the ground state and also the first two excited states in eV. **(05 Marks)**

3 a. Based on free electron theory, derive an expression for electrical conductivity of metals. How does electrical resistance change with impurity and temperature? **(09 Marks)**

b. Describe Fermi-Dirac distribution and discuss the same for different temperature conditions. **(06 Marks)**

c. The Fermi level in potassium is 2.1eV. What are the energies for which the probabilities of occupancy at 300 K are 0.99, 0.01 and 0.5? **(05 Marks)**

4 a. Explain the term internal field. Derive an expression for internal field in the case of one dimensional array of atoms in dielectric solids. **(08 Marks)**

b. Describe the nature of hard and soft magnetic materials. Discuss their applications. **(07 Marks)**

c. Sulphur is elemental solid dielectric whose dielectric constant is 3.4. Calculate the electronic polarisability if its density is $2.07\times10^{3}\text{kg/m}^3$ and atomic weight is 32.07. **(05 Marks)**

PART - B

5 a. Describe the construction and working of He-Ne laser with the help of energy level diagram. **(08 Marks)**

b. Describe the recording and reconstruction processes in Holography with the help of suitable diagrams. **(08 Marks)**

c. A He-Ne laser is emitting a beam with an average power of 4.5 mW. Find the number of photons emitted per second by the laser. The wavelength of the emitted radiation is 6328A^0. **(04 Marks)**

6 a. What is Superconductivity? Describe type I and type II superconductors. **(08 Marks)**

b. Explain the different types of optical fiber, along with the refractive index profile and mode propagation sketches. **(07 Marks)**

c. Calculate the numerical aperture, fractional index change and V – number for a fibre of core diameter 40μm and with refractive indices of 1.55 and 1.50 respectively for core and cladding. The wavelength of the propagating wave is 1400 nm. Assume that the fibre is in air. **(05 Marks)**

7 a. Define coordination number and packing factor. Calculate the packing factor for SC and bCC structures. **(08 Marks)**

b. Describe how Bragg's spectrometer is used for determination of crystal structure. **(07 Marks)**

c. An X-ray beam of wavelength 0.7A^0 undergoes minimum order Bragg reflection from the plane (302) of a cubic crystal at glancing angle 35^0. Calculate the lattice constant. **(05 Marks)**

8 a. Describe with theory a method of measuring velocity of ultrasonic waves in a liquid and mention how the bulk modulus of the liquid could be evaluated. **(08 Marks)**

b. What are nanomaterials? Write a note on carbon nanotubes. **(07 Marks)**

c. Discuss mechanical scaling. **(05 Marks)**

*****

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

06PHY12/22

First/Second Semester B.E. Degree Examination, June/July 08
Engineering Physics

Time: 3 hrs. Max. Marks:100

Note : *1. Answer any FIVE full questions, choosing at least two questions from each part.*

2. Physical Constants: Electron mass $m = 9.11 \times 10^{-31}$kg ; Electron charge $e = 1.6 \times 10^{-19}$C; Velocity of light $C = 3 \times 10^{8}$m/S; Planck's constant $h = 6.63 \times 10^{-34}$ JS; Avogadro number $N = 6.025 \times 10^{28}$/k mole; Permitivity of Vacuum $\epsilon_o = 8.85 \times 10^{-12}$ F/m; Boltzmann constant, $K = 1.38 \times 10^{-23}$ J/K

Part A

1 a. What is Planck's radiation law? Show how Wien's law and Rayleigh – Jeans's law can be derived from it. **(06 Marks)**

b. Explain phase velocity and group velocity. Derive the expression for de-Broglie wave length using the concept of group velocity. **(09 Marks)**

c. A particle of mass 0.65 MeV/C^2 has free energy 120 eV. Find its de Broglie wave length, C is the velocity of light. **(05 Marks)**

2 a. Show that electrons cannot exist in the nucleus of an atom. **(05 Marks)**

b. Discuss the Eigen function Eigen values and probability density for a particle in a potential well of infinite depth. **(10 Marks)**

c. An electron is bound in one dimensional infinite well of width 0.12 nm. Find the energy values and de Broglie wave lengths in the ground state and first excited state. **(05 Marks)**

3 a. Define drift velocity, mobility and relaxation time for free electron, derive the expression for conductivity interms of mean collision time. **(10 Marks)**

b. Show that occupation probability at $E = E_F + \Delta E$ is same as non –occupation probability at $E = E_F - \Delta E$, E_F is the Fermi energy. **(05 Marks)**

c. At what temperature we can expect 1% probability that an energy level 0.5 eV above Fermi level will be occupied. **(05 Marks)**

4 a. What are dielectrics? Derive the equation for internal field in liquids and solids for one dimensional array of atoms. **(10 Marks)**

b. What are hard and soft magnetic materials? Give their characteristic properties and applications. **(05 Marks)**

c. A parallel plate capacitor has an area of 6.45×10^{-4} m^2 and plates are separated by a distance of 2×10^{-3} m across which a potential of 10V is applied. If a material with dielectric constant 6 is introduced between the plates, determine the capacitance, the charge stored on each plate and the polarization. **(05 Marks)**

Part B

5 a. Derive the expression for energy density of radiation using Einstein's Coefficients. Compare the expression with Planck's equation. **(08 Marks)**

b. Explain the construction and working of He – Ne Laser. **(08 Marks)**

c. Find the ratio of population of two energy levels in a Laser if the transition between them produces light of wavelength 694.3 nm. Assume the ambient temperature to be 27^0 C. **(04 Marks)**

6 a. Discuss the three different types of optical fibres. **(06 Marks)**

b. Calculate the number of modes an optical fibre will transmit given the following data $n_{core} = 1.50$, $n_{clad} = 1.48$, core radius = 50 μm, wave length of light = 1μm. **(04 Marks)**

c. Discuss BCS theory of super conductivity. **(06 Marks)**

d. Write short note on Maglev vehicles. **(04 Marks)**

7 a. Explain how Miller indices are derived. Derive an expression for interplanar spacing of a crystal interms of Miller indices. **(10 Marks)**

b. Explain the structure of NaCl. **(06 Marks)**

c. X rays are diffracted in the first order from a crystal with d spacing 2.82×10^{-10} m at a glancing angle 6^0. Calculate the wave length of x – rays. **(04 Marks)**

8 a. What are Scaling laws? Give the electromagnetic scaling laws for both steady state and time varying system. **(10 Marks)**

b. Mention the factors which affect the velocity of ultrasonic waves in solids. Give the experimental method of determination of velocity of ultrasonic waves in liquids. **(10 Marks)**

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

06PHY12/22

First / Second Semester B.E. Degree Examination, Dec 08 / Jan 09
Engineering Physics

Time: 3 hrs. Max. Marks:100

Note : *1. Answer any FIVE full questions, selecting atleast two questions from each Part.*
2. Answer all objective type questions only in first and second writing pages.
3. Answer for objective type questions shall not be repeated.

Physical Constants : *Electron mass $m = 9.11\times 10^{-31}$ kg.*
Electron charge $= 1.6\times 10^{-19}$C, velocity of light $C = 3\times 10^{8}$m/s
Planks constants $h = 6.63\times 10^{-34}$J.S. Avagadros number $N = 6.025\times 10^{-28}$/K mol
Permitivity of vaccum $\epsilon_0 = 8.85\times 10^{-12}$F/m , Boltzman constant $k = 1.38\times 10^{-23}$ J/K.

PART – A

1 a. 1) The debroglic wave length associated with an electron of mass m and accelerated by a potential v is

i) $\frac{h}{\sqrt{2mve}}$ ii) $\frac{\sqrt{2mve}}{h}$ iii) $\frac{h}{vem}$ iv) $\frac{h}{2vem}$.

2) Davison and Gelmer were the first to demonstrate :
i) The straight line propogation of light ii) The diffraction of Photons
iii) The effective mass of electron iv) None of the these.

3) Electron behaves as waves because they can be :
i) Deflected by an electric field ii) Diffracted by a crystal
iii) Deflected by magnetic field iv) They ionize a gas.

4) In Davison – Gelmer experiment the hump is most prominent when the electron is accelerated by
i) 34 volts ii) 54 volts iii) 60 volts iv) 80 volts. **(04 Marks)**

b. Define Phase velocity and Group velocity. Show that Group velocity is same as particle velocity. **(08 Marks)**

c. Derive de – broglic wave length using Group velocity. **(04 Marks)**

d. Compare the energy of a photon with that of a neutron when both are associated with wave length of $1A^0$ given that the mass of neutron is 1.678×10^{-27}kg. **(04 Marks)**

2 a. 1) The product of uncertainty between angular momentum and angular displacement is

i) $\geq\frac{h}{2\pi}$ ii) $\geq\frac{h}{4\pi}$ iii) $\frac{h}{2\pi}$ iv) $\leq\frac{h}{4\pi}$.

2) Kinetic energy of electron accelerated by a voltage 50Votls.
i) 50ev ii) 10ev iii) 5ev iv) 15ev.

3) The energy of the lowest state in one dimensional potential box of length is

i) Zero ii) $\frac{2h^2}{8ma^2}$ iii) $\frac{h^2}{8ma^2}$ iv) $\frac{h}{8ma^2}$

4) The wave function for the motion of particles in one dimensional potential box of length a is given by $\psi_n = D\sin\frac{n\pi}{a}.x$. Where D is the normalization constant. The value of D is

i) $\frac{1}{a}$ ii) $\sqrt{\frac{2}{a}}$ iii) a iv) $\sqrt{\frac{a}{2}}$ **(04 Marks)**

b. Set up time independent schrodinger wave equation. **(06 Marks)**

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

d. A quantum particle confined to one dimensional box of width 'a' is in its first excited state. What is the probability of finding the particle over an interval of (a/2) marked symmetrically at the centre of the box? **(06 Marks)**

3 a. 1) If the mobility of electron in a metal increases the resistivity.

i) Decreases ii) Increases iii) Remains constant iv) none of these

2) Ohms law relates to the electric field E, conductivity σ and current density $\dot{J}$ as

i) $\dot{J} = E/\sigma$ ii) $\dot{J} = \sigma.E^2$ iii) $\dot{J} = \frac{\sigma}{E}$ iv) $\dot{J} = \sigma.E$

3) The average drift velocity Vd of electrons in a metal is related to the electric field E and collision time τ as

i) $\sqrt{\frac{eE\tau}{m}}$ ii) $\sqrt{\frac{m}{eE\tau}}$ iii) $\frac{eE\tau}{m}$, iv) $\frac{m}{eE\tau}$.

4) Experimentally specific heat at constant volume CV is given by

i) $\frac{3}{2}R$ ii) $10^{-4}RT$ iii) $\frac{2}{3}R$ iv) $10^{-4}R$. **(04 Marks)**

b. Write down the assumptions of classical free electron theory. **(04 Marks)**

c. Explain failure of classical free electron theory. **(06 Marks)**

d. Find the temperature at which there is 1% probability that a state with an energy 0.5ev above fermi energy is occupied. **(06 Marks)**

4 a. 1) The unit of dipole moment / unit volume is

i) Coulomb / metre ii) Coulomb / metre^2 iii) coulomb / metre^3 iv) Coulomb.

2) The flux density is related to the electric field as

i) $D = \varepsilon + E$ ii) $D = \varepsilon - E$ iii) $D = \varepsilon/E$ iv) $D = \varepsilon E$.

3) In a solid or liquid dielectric with external applied electrical field, as the electronic polarizability α_e increases the interval field E_i.

i) Increases ii) Reduces iii) Remains constant iv) none of these.

4) In a dielectric, the polarization is

i) Linear function of applied field ii) Square function of applied field

iii) Exponential functions of applied field iv) Logarithmic function of applied field. **(04 Marks)**

b. Derive an expression for internal field in case of one dimensional array of atoms in dielectric solids. **(06 Marks)**

c. Describe Ferro electrics. **(04 Marks)**

d. Sulphur is elemental solid dielectric whose dielectric constant is 3.4. Calculate electronic plarizability if its density is 2.07×10^3 kg/m^3 and atomic wt is 32.07. **(06 Marks)**

PART – B

5 a. 1) The emission of photon without being aided by any external agency is called

i) Light amplification ii) Induced absorption iii) Stimulated emission

iv) Spontaneous emission.

2) n, be the number density of lower energy E, and n_2 be the number density of higher energy E_2, if $n_2 > n_1$ is called
   i) Thick population ii) Inverted population
   iii) Normal population iv) No population.
3) Supply of energy to atoms for excitation is called
   i) Glowing ii) Bombarding iii) incidenting iv) Pumping.
4) Important characteristic of Laser beam is
   i) Interference ii) Diffraction iii) Dispersion iv) Coherence. **(04 Marks)**

b. Obtain an expression for energy density of radiation under equilibrium condition in terms of Einstein co-efficient. **(08 Marks)**

c. Describe the construction and working of Semiconductor laser. **(08 Marks)**

6 a. 1) The temperature at which super conductivity occurs is called :
   i) Low temperature ii) Super temperature
   iii) Critical temperature iv) High temperature.
2) Super conductivity phenomenon can be explained on the basis of :
   i) BCS theory ii) CCS theory iii) DCS theory iv) MCS theory
3) Meissner effect will take place in
   i) Solid ii) Super conducting magnet iii) Magler vehicle iv) MRI.
4) Loss of power during transmission through optical fiber is called.
   i) Power loss ii) Energy loss iii) Attenuation iv) Modification. **(04 Marks)**

b. Explain Meissner effect. **(06 Marks)**

c. Obtain an expression for numerical aperture and arrive the condition for propagation. **(06 Marks)**

d. The angle of acceptance of an optical fiber is 30^0 when kept in air. Find the angle of acceptance when it is in a medium of refractive index 1.33. **(04 Marks)**

7 a. 1) The coordination number in the case of simple cubic crystal structure is
   i) 12 ii) 6 iii) 2 iv) 1.
2) Which of the following metal crystallizes in fcc structure
   i) Aluminium ii) Zinc iii) Sodium iv) Calcium chloride
3) The number of molecules present in unit cell of sodium chloride is
   i) 5 ii) 2 iii) 4 iv) None of these.
4) The Miller indices of the plane parallel to x and y axis are
   i) (100) ii) (010) iii) (001) iv) (111) **(04 Marks)**

b. How do you find miller indices of a given plane. **(04 Marks)**

c. Derive an expression for interplaner spacing in terms of miller indices. **(08 Marks)**

d. Calculate the glancing angle for incidence of X rays of wave length $0.58A^0$ on the plane (132) of NaCl which results in second order diffraction maxima taking the lattice as $3.81A^0$. **(04 Marks)**

8 a. 1) A constant testing of product without causing any damage is called **(04 Marks)**
   i) Minute testing ii) Destructive testing
   iii) Non destructive testing iv) Random testing.
2) The state of matter around the nano size is known as
   i) Solid state ii) Liquid state iii) Plasma state iv) Meroscopic state
3) If the reduction is in two direction the resultant structure will be in one dimension which is called
   i) Reduced structure ii) Thin wire iii) Quantum wire iv) Enlarge structure.
4) The signal due to a reflected wave is called
   i) Transmitted wave ii) Longitudinal wave iii) Echo iv) Peaco.

b. Describe a method of measuring velocity of ultrasonic waves in solids. **(08 Marks)**

c. Explain nano tubes and its applications. **(08 Marks)**

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

06PHY12/22

First/Second Semester B.E. Degree Examination, June-July 2009
Engineering Physics

Time: 3 hrs. Max. Marks:100

Note : 1. ***Answer any Five full question, choosing at least two from each part.***
2. ***Answer all objectives type questions only in OMR sheet page 5 of the Answer Booklet.***
3. ***Answer to the objective type questions on sheets other than OMR will not be valued.***
4. ***Physical contents : $h = 6.62\times10^{-34}$ J-S ; $c = 3\times10^{8}$ m/s ; $m_e = 9.1\times10^{-31}$ kg.***

PART - A

1 a. i) An electron and a proton are accelerated through same potential. The ratio of deBroglie wave length $\lambda e/\lambda p$ is

A) 1 B) me/mp C) mp/me D) $\sqrt{\frac{mp}{me}}$

ii) Wave function associated with a material particle is :
A) Single valued B) Finite C) Continuous D) ALL the above

iii) In a black body radiation Spectrum, the maximum energy peaks shifts towards the shorter wave length side with the increase in temperature. This confirms
A) Stefan's law B) Wein's law
C) Rayleigh-Jean's law D) Planck's law

iv) The group Velocity of the particle is 3 X 10^6 m/s, whose Phase velocity is
A) 6.06 X 10^6 m/s B) 3 X 10^{10} m/s
C) 3n m/s D) 1.5 X 10^{10} m/s **(04 Marks)**

b. Describe Davisson and Germer experiment for confirmation of deBroglie hypothesis. **(08 Marks)**

c. Explain phase and group velocity. Calculate the deBroglie wavelength of a bullet of mass 5gm moving with velocity 20 km/h. **(08 Marks)**

2 a. i) According to Max Born approximation $|\psi|^2$ represents
A) Energy density B) Particle density
C) Probability density D) Charge density

ii) An electron has a speed of 100 m/s, accurate to 0.005%. The uncertainty in its position is
A) 0.01m B) 0.0115m C) 0.024m D) 0.04m

iii) An electron moving in a box of length 'a'. If ψ_1 is the wave function at $x^1 = \frac{a}{4}$ with n = 1 and ψ_2 at x = a for n = 2, then $\frac{\psi_2}{\psi_1}$ is

A) $\frac{\sqrt{2}}{a}$ B) $\sqrt{\frac{a}{2}}$ C) 0 D) ∞

iv) The lowest quantised energy of a particle of mass m in a box of length L is given by

A) zero B) $h^2/8mL^2$ C) $\frac{2h^2}{8mL^2}$ D) $\frac{h^2}{2mL^2}$ **(04 Marks)**

b. Explain Heisenberg's uncertainty principle. Give its physical significance. **(06 Marks)**

c. Set up Time-independent one-dimensional Schodinger wave equation. **(06 Marks)**

d. A equation particle confined to one dimensional box of width in its first exited state. What is the probability of finding particle at interval of $\frac{a}{2}$ marked symmetrically at the centre of the box. **(04 Marks)**

3 a. i) If the mobility of the electron is 7×10^{-3} m^2/vs, when accelerated by a field 1v/cm, the V^d is given by

A) 7×10^{-3}m/s B) 0.7m/s C) 7×10^{-2}m/s D) 0.007m/s

ii) The temperature dependence for electrical resistivity of metal is

A) $\rho\alpha\frac{1}{T}$ B) $\rho\alpha\frac{1}{\sqrt{T}}$ C) $\rho\alpha\sqrt{T}$ D) $\rho\alpha T$

iii) The Fermi factor for $E = E_f$ at $T > OK$ is

A) 1 B) $\frac{1}{2}$ C) 0 D) 2

iv) According to Quantum Free electron Theory, the energy level in a metal are

A) Continuous B) Discrete C) Overlapping D) None. **(04 Marks)**

b. Derive an expression for Density of states for conduction electron for unit volume of metal. **(08 Marks)**

c. Discuss the various drawbacks of classical free electron theory of metals. What are the assumption made in quantum theory to over come. **(08 Marks)**

4 a. i) The Polarisation that occur in the frequency range $10^{12}H_2$ is

A) Ionic B) Electronic C) Orientation D) Space charge

ii) If two electric charges are q, separated by a distance L. The dipole moment of the system is

A) q/L B) L/q C) qL D) q/L^2

iii) Choose the correct relation

A) $E = \epsilon_0(\epsilon_r - 1)P$ B) $P = \epsilon_0(\epsilon_r - 1)E$ C) $\epsilon_r = K - 1$ D) $D = \epsilon_0(\epsilon_r - 1)E$

iv) If the distance between the plates of capacitor is increased double, the capacitance is

A) Doubled B) Increased to four times C) Halved D) Constant **(04 Marks)**

b. Derive the equation for internal field in case of solid or liquid dielectric for one dimensional. **(08 Marks)**

c. Derive Clausius-Mossuti equation for 3-dimensional cubic solid dielectric. **(08 Marks)**

PART - B

5 a. i) Pumping process used in diode laser is

A) Optical pumping B) Forward bias C) Electric discharge D) None of these

ii) The life time of an atom on a metastable state is of the order

A) a few seconds B) unlimited

C) a nano second D) few milli second

iii) The purpose of the optical resonator in a laser is

A) to provide cover to the active medium B) to provide path for atoms

C) to provide selectivity of photons D) to send laser in specified direction

iv) In He-Ne lasers, the ratio of He-Ne is in the order

A) 1:10 B) 1:1 C) 10:1 D) 100:1 **(04 Marks)**

b. With the help of energy level diagram, describe the construction and working of He-Ne laser. **(08 Marks)**

c. Write a note on measurement of Pollutants in a atmosphere using laser. **(04 Marks)**

d. A laser beam with Power per pulse is mw lasts 10ns, if the number of photons emitted per pulse is 3.941×10^7, calculate the wavelength of laser. **(04 Marks)**

6 a. i) Numerical aperture of an optical fiber depends on

A) Diameta of the Fiber B) Acceptance angle

C) Critical angle D) η_{core} material

ii) The width of the energy gap of a super conductor is maximum at

A) T_c B) OK C) $\frac{T_c}{2}$ D) $\frac{T_c}{3}$

iii) Which of the following is correct?

A) Cladding is for providing greater strength B) Core has higher R.I than cladding
C) Cladding has higher R.I than core D) None.

iv) Fractional index changes of Optical Fiber for R.I of core and cladding are 1.563 and 1.498 is

A) 0.00415 B) 0.0415 C) 0.043 D) 0.004 **(04 Marks)**

b. With neat figure derive an expression for N.A in an optical Fiber. **(06 Marks)**

c. Give a brief account of SQUID. **(06 Marks)**

d. A Fiber 500m long has an input power of 8.6 mw and out put power 7.5 mw. What is the loss specification in cable? **(04 Marks)**

7 a. i) The relation between atomic radius and lattice constent in FCC structure is

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

ii) APf of diamond crystal structure is

A) 0.68 B) 0.74 C) 0.52 D) 0.34

iii) A crystal of Tetragonal lattice is

A) $a = b = c$ B) $a \neq b \neq c$ C) $a = b \neq c$ D) $a \neq b = c$

iv) For every rotation by an angle θ in Bragg's spectrometer, detector turns by an angle

A) θ B) 3θ C) $\theta/2$ D) 2θ **(04 Marks)**

b. Derive an expression for inter planar spacing in terms of miller indices. **(06 Marks)**

c. With neat fig, explain crystal structure of Nacl. **(06 Marks)**

d. The minimum order of Bragg's reflection occurs at angle of 20^0 in the plane [2 1 2]. Find the wave length of x-rays if lattice constant is $3.615A^0$. **(04 Marks)**

8 a. i) Carboon nano tube are molecular structures of

A) Graphite sheet B) Graphene sheet C) Plastic D) None.

ii) As per the scaling laws, the frequency of operation increases with

A) Decrease of size B) Increase of size C) Constant D) None

iii) The ultra Sonics can exist only as longitudinal waves in

A) Solid B) Liquid C) Gases D) All the above

iv) The velocity of ultrasonic waves through the liquid is proportional to

A) Bulk modulus B) Density C) Volume D) Rigidity modulus **(04 Marks)**

b. What are nano materials? Write a note on carbon nano-tubes. **(06 Marks)**

c. Describe a method of measuring velocity of ultrasonic waves in liquid. **(10 Marks)**

* * * * *

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

06PHY12/22

First/Second Semester B.E. Degree Examination, Dec.09/Jan.10
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 in OMR sheet page 5 of the Answer Booklet.
3. Answer to objective type questions on sheets other than OMR will not be valued.
4. Physical constants: Electron mass = 9.1×10^{-31}kg, Neutron mass = 1.675×10^{-27}kg, $h = 6.63\times10^{-34}$Js, $K = 1.38\times10^{-23}$J/K, $N_A = 6.025\times10^{23}$/mole, $\varepsilon_0 = 8.85\times10^{-12}$.

PART – A

1 a. i) Wien's law is deduced from Planck's radiation formula under the condition of
A) Very small wavelength and temperature B) Large wavelength and temperature
C) Small wavelength and high temperature D) Large wavelength and small temperature

ii) The Compton wavelength is given by
A) $\frac{h}{m_0C^2}$ B) $\frac{h^2}{m_0C^2}$ C) $\frac{h}{m_0C}$ D) $\frac{h^2}{2m_0C}$

iii) Which of the following relations can be used to determine de Broglie wavelength associated with a particle?
A) $\frac{h}{\sqrt{2mE}}$ B) $\frac{h}{mv}$ C) $\frac{h}{\sqrt{2meV}}$ D) All of these.

iv) If the group velocity of a particle is 3×10^6 m/s, its phase velocity is
A) 100 m/s B) 3×10^6 m/s C) 3×10^8 m/s D) 3×10^{10} m/s **(04 Marks)**

b. What is Planck's radiation law? Show how Wien's law and Rayleigh-Jean's law can be derived from it. **(06 Marks)**

c. Define group velocity. Derive relation between group velocity and phase velocity. **(06 Marks)**

d. A fast moving neutron is found to have a associated de Broglie wavelength of 2Å, find its kinetic energy and group velocity of the de Broglie waves. **(04 Marks)**

2 a. i) The normalization of wave function is always possible, if
A) $\int_{-\infty}^{\infty}\psi\psi^*dx$ = infinite B) $\int_{-\infty}^{+\infty}\psi\psi^*dx$ = finite
C) $\int_{-\infty}^{+\infty}\psi\psi^*dx = 0$ D) All of these.

ii) Schrodinger's time independent equation is applicable for the particles with
A) Constant energy B) Variable energy
C) Only constant potential energy D) All of these.

iii) The ground state energy of an electron in an infinite well is 5.6 meV. If the width of the well is doubled, the ground state energy is
A) 9.92×10^{-23} J B) 4.48×10^{-22} J C) 2.24×10^{-22} J D) None of these.

iv) The wave function is acceptable wave function if it is
A) finite everywhere B) Continuous everywhere
C) Single valued everywhere D) All of these. **(04 Marks)**

b. State Heisenberg's uncertainty principle and discuss its physical significance. **(06 Marks)**

c. Solve the Schrodinger's wave equation for allowed energy values in case of a particle in a potential box. **(10 Marks)**

3 a. i) For ordinary metals, the resistivity versus temperature curve at T = 0,
A) has a positive intercept B) has a negative intercept
C) goes through the origin D) none of these.

ii) Which one of the following relation is correct for current density?
A) $J = neAV_d$ B) $J = \frac{neA}{V_d}$ C) $J = neV_d$ D) $J = \frac{1}{neV_d}$

iii) The value of Fermi distribution function at absolute zero (T = 0 K) is 1, under the condition
A) $E = E_F$ B) $E > E_F$ C) $E >> EF$ D) $E < E_F$

iv) If the Fermi energy of silver is 5.5 eV, the Fermi velocity of conduction electron is
A) 0.98×10^6 m/s B) 1.39×10^6 m/s C) 2.46×10^5 m/s D) None of these. **(04 Marks)**

b. Describe how quantum free electron theory has been successful in overcoming the failures of classical free electron theory. **(06 Marks)**

c. What is Fermi energy? Discuss variation of Fermi factor with energy and temperature. **(06 Marks)**

d. Calculate the probability of an electron occupying an energy level 0.02 eV above the Fermi level at 200 K, in a material. **(04 Marks)**

4 a. i) What changes in the capacitance of a capacitor occurs if the dielectric material is removed?
A) Increases B) Decreases C) Remains same D) None of these.

ii) The relation between B, M and H is
A) $H = \mu_0(M + B)$ B) $M = \mu_0(H + B)$ C) $B = \mu_0(H + M)$ D) None of these.

iii) Sulphur is an elemental solid dielectric of atomic weight 32.07 and density $2.07\times10^3 kg/m^3$. The number of atoms per unit volume for sulphur is
A) $3.89\times10^{28}/m^3$ B) $3.89\times10^{25}/m^3$ C) $9.3\times10^{24}/m^3$ D) None of these.

iv) Which one of the following is necessarily the piezoelectric material?
A) Lead B) Mica C) Iron D) Quartz. **(04 Marks)**

b. What is meant by polarization mechanism in dielectrics? Discuss any three different polarization mechanisms in dielectrics and their frequency dependence. **(08 Marks)**

c. Describe hard and soft magnetic materials. **(04 Marks)**

d. An elemental solid dielectric material has polarisability 7×10^{-40} Fm^2. Assuming the internal field to be Lorentz field, calculate the dielectric constant for the material, if it has 3×10^{28} atoms/m^3. **(04 Marks)**

PART – B

5 a. i) The life time of an atom at the ordinary excited state is of the order of
A) few mili second B) few nano second C) few micro second D) Unlimited.

ii) The relation between Einstein's coefficients A and B is
A) $\frac{8\pi h\lambda^3}{c^3}$ B) $\frac{8\pi h^2\nu^3}{c^3}$ C) $\frac{8\pi h\nu^3}{c^3}$ D) $\frac{8\pi h\nu^3}{c^2}$

iii) The number of modes of standing waves in the resonant cavity of length 1m, if He-Ne laser operating at wavelength of 6328 Å is
A) 3.14×10^6 B) 1.58×10^6 C) 3.16×10^8 D) None of these.

5 a. iv) From a broken hologram which is 10% of the original, if reconstruction of image is being done, then
A) Only 10% of information of the object can be obtained
B) Complete information of the object is obtained
C) No information of the object can be obtained
D) None of these. **(04 Marks)**

b. Obtain an expression for energy density of radiation under equilibrium condition in terms of Einstein coefficient. **(07 Marks)**

c. Describe the recording and reconstruction processes in holography, with the help of suitable diagrams. **(05 Marks)**

d. A ruby laser emits pulse of 20 ns duration with average power per pulse being 100kW. If the number of photons in each pulse is 6.981×10^{15}, calculate the wavelength of photons. **(04 Marks)**

6 a. i) In a single mode fibre, the diameter of the core is nearly equal to
A) 125 μm B) 100 μm C) 50 μm D) 10 μm

ii) The numerical aperture of an optical fibre is 0.2 when surrounded by air. The acceptance angle when the fibre is in water of refractive index 1.33 is
A) 8.21′ B) 8.65′ C) 0.11′ D) None of these.

iii) The loss of power by the optical signal through the optical fibre is mainly due to
A) Rayleigh scattering B) Raman scattering C) Wein's scattering D) All of these.

iv) When the type-I superconducting material is placed in an external magnetic field, it
A) attracts the magnetic lines B) enhances the magnetic field lines
C) repels the magnetic field lines D) does not influence magnetic field of lines **(04 Marks)**

b. Describe the point to point communication system, with the help of a block diagram. **(05 Marks)**

c. Discuss BCS theory of superconductor. Explain SQUID. **(07 Marks)**

d. An optical glass fibre of refractive index 1.50 is to be clad with another glass to ensure internal reflection that will contain light travelling within 5° of the fibre axis. What maximum index of refraction is allowed for the cladding? **(04 Marks)**

7 a. i) Which one of the following crystal is an example of monoclinic?
A) SnO_4 B) NaCl C) $CaSO_4$ D) $CuSO_4$

ii) In a simple cubic lattice the ratio $d_{100} : d_{110} : d_{111}$ is
A) 6 : 3 : 1 B) $\sqrt{3} : \sqrt{6} : 1$ C) $6 : 3 : \sqrt{2}$ D) $\sqrt{6} : \sqrt{3} : \sqrt{2}$

iii) Which one of the following Bravais lattices is not found in cubic crystal?
A) Simple cube B) Face centered C) Body centered D) Base centered.

iv) The packing fraction of diamond crystal structure is
A) 34% B) 52% C) 68% D) 74% **(04 Marks)**

b. Discuss the Bravais lattice and any five crystal systems with the help of illustrations. **(08 Marks)**

c. Define coordination number and packing factor. Calculate the packing factor for sc, fcc and bcc structures. **(08 Marks)**

8 a. i) Which one of these does not represent a type of carbon nano tube?
A) Arm chair B) Wavy C) Zig-zag D) Arch discharge.

ii) The bulk material reduced in two directions is known as
A) Quantum dot B) Quantum wire C) Film D) Reduced structure.

iii) The ultrasonic waves are produced by
A) Electromagnetic induction B) Electric tuning fork
C) Piezoelectric effect D) Inverse piezoelectric effect.

iv) Which of the procedures is not employed to detect the internal flaws of a material?
A) Ultrasonic method B) Magnetic method
C) Alpha ray method D) Dynamic testing **(04 Marks)**

b. Discuss the variation of density of states for different quantum structures. **(08 Marks)**

c. What is non-destructive testing? Explain with principle, how flaw in a solid can be detected by non-destructive method, using ultrasonics. **(08 Marks)**

* * * * *

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

06PHY12/22

First/Second Semester B.E. Degree Examination, May/June 2010
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 in OMR sheet page 5 of the Answer Booklet.
3. Answer to objective type questions on sheets other than OMR will not be valued.
4. Physical Constants: Velocity of light, $c = 3\times10^{8} ms^{-1}$, Plank's constant, $h = 6.625\times10^{-34} JS$, Electron charge, $e = 1.602\times10^{-19} C$, Mass of electron, $m = 9.11\times10^{-31} kg$, Avogadro number, $N_A = 6.02\times10^{26}/K$ mole, Permittivity of vacuum, $\varepsilon_o = 8.85\times10^{-12} Fm^{-1}$, Boltzmann constant, $K = 1.38\times10^{-23} J/K$.

PART – A

1 a. i) In a blackbody radiation spectrum, the Wein's distribution law is applicable only for
A) Longer wavelength B) Shorter wavelength
C) Entire wavelength D) None of these.

ii) The de Broglie wavelength associated with an electron of mass m and accelerated by a potential V is

A) $\frac{h}{2Vem}$ B) $\frac{\sqrt{2mVe}}{h}$ C) $\frac{h}{\sqrt{Vem}}$ D) $\frac{h}{\sqrt{2mVe}}$

iii) Electron behaves as a wave because they can be
A) Diffracted by a crystal B) Deflected by magnetic field
C) Deflected by electric field D) Ionise a gas.

iv) If the group velocity of de Broglie wave is 4×10^8m/sec, its phase velocity is
A) 12×10^8m/sec B) 2.25×10^8m/sec C) 5.33×10^8m/sec D) 1.33×10^8m/sec. **(04 Marks)**

b. Explain duality of matter waves. **(04 Marks)**

c. Define phase velocity and group velocity. Show that group velocity is equal to particle velocity. **(08 Marks)**

d. Calculate the momentum of the particle and de Broglie wavelength associated with an electron with a kinetic energy of 1.5 K eV. **(04 Marks)**

2 a. i) If free electron exists in a nucleus, its energy value must have a minimum energy of about
A) 4 MeV B) 20 MeV C) 20 KeV D) 10 KeV

ii) According to Max Born approximation $|\psi^2|$ represents
A) Charge density B) Particle density C) Energy density D) Probability density.

iii) If E_1 is the energy of the lowest state of a one dimensional potential box of length 'a' and E_2 is the energy of the lowest state when the length of the box is halved, then
A) $E_2 = E_1$ B) $E_2 = 2E_1$ C) $E_2 = E_1/2$ D) $E_2 = 4E_1$

iv) The wave function for the motion of the particle in a one dimensional potential box of length 'a' is given by $\psi_n = A \sin\left(\frac{n\pi x}{a}\right)$, where A is normalization constant. The value of A is

A) $\frac{1}{\sqrt{a}}$ B) $2/\sqrt{a}$ C) $\sqrt{2/a}$ D) $\sqrt{a/2}$. **(04 Marks)**

b. State and explain Heisenberg's uncertainty principle and prove that nuclei do not contain electron. **(08 Marks)**

c. Discuss the wave functions and probability density for particle in an infinite potential well, for first two states. **(04 Marks)**

d. An electron is bound in one dimensional potential well of width 0.18 nm. Find the energy value in eV of the second excited state. **(04 Marks)**

3 a. i) The collision time and root mean square velocity of an electron at room temperature are 3×10^{-14}sec and 1×10^{5}m/s respectively. The classical value of mean free path of the electron is

A) 3×10^{-19}nm B) 3 °A C) 3 nm D) 17.3 nm

ii) Mobility of electron is

A) Reciprocal of conductivity
B) Flow of electronsper unit
C) Reciprocal of resistivity
D) Average electron drifts velocity per unit electric field.

iii) The quantum mechanical expression for electrical conductivity is

A) $\sigma = \frac{m^* \upsilon_F}{ne^2\lambda_F}$ B) $\sigma = \frac{ne^2\lambda_F}{m^2\upsilon_F}$ C) $\sigma = \frac{m^* \upsilon_F}{n^2e^2\lambda_F}$ D) $\sigma = \frac{m^*}{ne^2\lambda_F}$

iv) If the Fermi energy of metal at 0°K is 5 ev, f(E) for Fermi energy at T > 0°K is

A) 0.5 eV B) 1 eV C) 0.75 eV D) 0 eV. **(04 Marks)**

b. Define relaxation time and discuss the dependence of electrical resistivity of metals with temperature and impurity. **(06 Marks)**

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

d. A uniform silver wire has resistivity 1.54×10^{-8} ohm-m at room temperature for an electric field 2 v/m. Calculate relaxation time and drift velocity of the electrons, assuming that there are 5.8×10^{22} conduction electrons per cm^3 of the material. **(04 Marks)**

4 a. i) For a given dielectric, the electron polarizability, α_e

A) Increases with temperature
B) Decreases with temperature
C) Independent of temperature
D) May increase or decrease with temperature.

ii) If two point charges of opposite sign + q and – q are separated by a distance l. The electric dipole moment is

A) q/l B) q/l^2 C) $[(+q)(-q)]/l^2$ D) ql

iii) The polarization that occurs in the frequency range 10^{13} to 10^{16} Hz is

A) Electronic B) Orientational C) Ionic D) Space charge

iv) For ferromagnetic substance, the Curie – Weiss law is given by

A) $\chi = C/T$ B) $\chi = \frac{C}{(T-\theta)}$ C) $\chi = \frac{(T-\theta)}{C}$ D) $\frac{C}{(T+\theta)}$. **(04 Marks)**

b. What is internal field? Derive an expression for the internal field incase of one – dimensional array of atoms in solids or liquids. **(08 Marks)**

c. What are soft magnetic materials? Discuss their properties. **(04 Marks)**

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

PART – B

5 a. i) Which of the following is not a laser property?
A) Highly monochromatic
B) High directionality
C) Very narrow band width
D) Highly divergent.

ii) The life time of an atom in the excited state is of the order of
A) Millisecond B) Few seconds
C) Nano seconds D) Unlimited.

iii) Pumping technique used in He – Ne gas laser is
A) Forward bias
B) Optical pumping
C) Electrical discharge
D) High injection current.

iv) 3D image of an object constructed by hologram is the process of
A) Intensity recording
B) Phase information recording
C) Both phase and intensity information recording
D) Transmission and reflection recording. **(04 Marks)**

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

c. Describe the construction and working of semiconductor laser. **(06 Marks)**

d. Calculate on the basis of Einstein's theory the number of photons emitted per second by He – Ne laser source emitting light of wavelength 6328°A with an optical power 10 mw. **(04 Marks)**

6 a. i) Superconductor in superconducting state behaves as
A) Monovalent metals
B) Ferro magnetic materials
C) Good conductors at room temperature
D) Diamagnetic materials.

ii) A super conducting material, on being subjected to the critical field, changes to
A) Critical conductivity
B) Superconducting which is independent of temperature
C) Normal state
D) Remains uninfluenced.

iii) Fractional index change of optical fiber and refractive index of core are 0.00515 and 1.533 respectively. The cladding refractive index is
A) 1.492 B) 1.525 C) 1.499 D) 1.511

iv) Attenuation in the optical fiber causes due to
A) Absorption B) Scattering C) Dispersion D) All the three. **(04 Marks)**

b. What is Meissner effect? Explain the BCS theory of superconductors. **(08 Marks)**

c. Derive the expression for numerical aperture of an optical fibre. **(04 Marks)**

d. An optical fiber has core R.I. 1.5 and R.I. of cladding is 3% less than the core index. Calculate the numerical aperture, angle of acceptance and internal critical acceptance angle. **(04 Marks)**

7 a. i) Nearest neighbour distance between two atoms in case of bcc structure is

A) $(a\sqrt{3})/2$ B) $2a/\sqrt{3}$

C) $(a\sqrt{2})/2$ D) $2a/\sqrt{2}$

ii) The co-ordination number in case of simple cubic crystal structure is

A) 12 B) 8

C) 2 D) 6

iii) The crystal with lattices $a = b \neq c$ and angles $\alpha = \beta = \gamma = 90^{\circ}$ represents

A) Cubic B) Hexagonal

C) Orthorhombic D) Tetragonal.

iv) A plane intercepts at a, b/z, 2c in a simple cubic unit cell. The miller indices of the plane are

A) (214) B) (241)

C) (421) D) (124). **(04 Marks)**

b. Define unit cell and primitive cell. Describe crystal structure of diamond. **(08 Marks)**

c. Derive Bragg's law. **(04 Marks)**

d. A monochromatic X – ray beam of wavelength 1.5 °A undergoes second order Bragg reflection from the plane (211) of a cubic crystal, at a glancing angle of 54.38°. Calculate the lattice constant. **(04 Marks)**

8 a. i) The elastic behaviour of the liquid is characterized by its

A) Young's modulus B) Modulus of rigidity

C) Bulk modulus D) Poisson's ratio

ii) The relation between longitudinal velocity and transverse velocity of ultrasonics in the given material is

A) Longitudinal velocity is same as transverse velocity

B) Longitudinal velocity is greater than transverse velocity

C) Transverse velocity is greater than longitudinal velocity

D) Transverse velocity is double the longitudinal velocity.

iii) The state of matter around the nano size is known as

A) Liquid state B) Plasma state

C) Mesoscopic state D) Solid state.

iv) A bulk material (three dimensions) reduced in two directions is known as

A) Quantum dot B) Quantum particle

C) Film D) Quantum wire. **(04 Marks)**

b. Explain density of states for various quantum structures. **(08 Marks)**

c. What is non destructive testing? Describe the method of measuring velocity of ultrasonic waves in solids. **(08 Marks)**

* * * * *